

SHAPING PUBLIC PERCEPTIONS?
THE SCIENCE AND SCIENTISTS IN SCIENCE FICTION TELEVISION

By

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To my family, the source of my inspiration and energy

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ABSTRACT

Abstract of Thesis Presented to the Graduate School
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SHAPING PUBLIC PERCEPTIONS? THE SCIENCE AND SCIENTISTS IN SCIENCE FICTION TELEVISION

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A large body of research is dedicated to understanding how science is being communicated to, and perceived by, the public. The vast majority of images of science and scientists reach the public through film and television entertainment, not news. These images of science and scientists in film and television entertainment reach millions of people, and yet very little research has examined these images and attempted to understand how they represent science and scientists to the public. This study is a first step toward building a body of research dedicated to the study of what entertainment media is communicating about science, and how those media could be influencing public perceptions of science and scientists.

This study is a thorough examination of the representations of science and scientists in popular and modern science fiction television shows. As a first step toward building an understanding of how television entertainment represents science and scientists, content analysis was used to examine 108 episodes of the top 20 most popular science fiction television shows that aired during 1987-2007. One finding was that the small screen image of scientists has dramatically improved and progressed from that of the 1950s mad scientist. The modern science fiction scientist is typically a young, attractive, well-groomed “regular” guy or girl that is often

indistinguishable from other characters. A comparison of the changes in science fiction television programs over the period of 21 years revealed that the science fiction genre has increased its presence on both network and cable stations. As the amount of science fiction on television increases, science fiction content is reaching a greater number of people. If the representations or misrepresentations of science and scientists in science fiction are reaching larger audiences, then those portrayals have an increasing potential to influence the way that viewers think about science and scientists.

Findings about gender, ethnicity, physical appearance, characterizations, types of scientists, types of sciences, science fiction themes, and beneficial versus harmful portrayals of science and scientists are discussed in the context of their usefulness to science teachers and educators, scientists, social and communications researchers, and science policy makers and advocates.

CHAPTER 1 INTRODUCTION

As technology speeds ahead, science plays an increasingly prominent role in our daily lives. While the news media tell stories of the latest science research, advancements and setbacks, the most prevalent images of science and scientists are in the stories told by film and television entertainment, not news (Frayling, 2005; Lambourne 1999; Lambourne, Shallis & Shortland, 1990).

Images and stories of science are present in all genres of film and television entertainment. In considering the volume of material in film and television entertainment, and the debatable nature of what qualifies as images of science, any attempt to include all this material in one study would indeed be a grand undertaking. In an attempt to provide a comprehensive and in-depth analysis, this study will examine one genre in one medium—images of science and scientists in science fiction television programming.

A tremendous boom in science fiction programming in the 1980s and early 1990s meant that by 1992, science fiction programming had become popular enough to support its own cable network—the Sci-Fi Channel (Sconce, n.d.). The science fiction boom has continued into the 21st century. Major networks, NBC, ABC, CBS and FOX, which traditionally regarded the science fiction genre as too risky for primetime have all taken on shows that delve into science fiction and supernatural themes (Frutkin, 2006; Umstead, 2007).

As science fiction programming explodes on both network and cable television (Frutkin, 2006), now more than ever these images are in a position to influence public perception and attitudes of science and scientists. Communications scholar George Gerbner asserts that American adults learn their science primarily from television (as cited in LaFollette, 1981). As a mass medium, television has the power to influence viewer's conceptions of reality (Gerbner &

Gross, 1976). Because science is often dependent upon public funding, and researchers suggest that funding is affected by public opinions (Treise & Weigold, 2002), the conceptions of science being communicated through popular entertainment has become an area of considerable interest to researchers and government. Since 1972 the National Science Board has been funding research and releasing biannual reports that address the issues of public attitudes toward science and technology (as cited in Elliott & Rosenberg, 1987), the most recent of which was published in February of 2008 (NSB, 2008).

A substantial body of research evolved as scholars explored and documented the problems of communicating science to the public, the media influences upon public perception and understating of science, and the resulting public attitudes toward science and scientists (Bucchi, 1998; Dowie, 1998; Miller, 2001; Treise & Weigold, 2002). Despite these concerns and the eschewing body of research into science communications, there has been only limited research focusing on the representation of science and scientists in popular entertainment (Kirby, 2003a; LaFollette, 2002; Lambourne et al., 1990; Weingart, 2003). At the time of this study, the researcher was unable to locate any major published studies examining the images of science and scientists in science fiction television.

The historical lack of research directly related to science fiction television programming is not so surprising. Science fiction television has traditionally had a small and select audience (Tulloch & Jenkins, 1995). In its early stages science fiction programming catered to an audience of children (Sconce, n.d.). As the decades passed and the genre developed on the small screen, more shows were targeted toward adults (Sconce, n.d.); adding some diversity and size to the audience demographics. In 1972, organizers at the first ever *Star Trek* convention were surprised when attendance exceeded 3,000; they had been expecting a few hundred (Tulloch &

Jenkins, 1995). Still, 3,000 fans at a *Star Trek* convention were not enough to turn the heads of major networks. Between the costs associated with producing believable science fiction stories, and the challenges of attracting advertisers with such limited audience demographics and size, science fiction was largely ignored by network television (Frutkin, 2006; Umstead, 2007; Sconce, n.d.). Then came the 21st century, and with it, two major developments that brought science fiction programming to the attention of both advertisers and producers (Frutkin, 2006; Parks, 2000; Umstead, 2007). First, the success of television shows like *Lost* (2004), *Battlestar Galactica* (2003) and *Heroes* (2006), which have unexpectedly attracted large mainstream audiences, and second, the advances in CGI (computer-generated imagery) that have dramatically reduced the costs of producing believable science fiction for the small screen (McLean, 2007). *Heroes* creator Tim Kring explains the leaps forward in technology and the impact they have had on television special effects—“extraordinary things that took giant mainframe computers and 12 programmers to do 10 years ago, a guy on a Macintosh can do now” (McLean, 2007, para. 12). With these developments, science fiction television has emerged from the “dark side of scripted TV” to a primetime position (Umstead, 2007).

Given the current pervasiveness of science fiction programming (Frutkin, 2006; Umstead, 2007), the dominance of entertainment media in constructing images of science (Frayling, 2005; Lambourne et al., 1990), and the demonstrated effects of television viewing upon public attitudes and perceptions (Gerbner & Gross, 1976), it is crucial to examine these images of science being funneled to the public via science fiction television. The power of these fictional images in science entertainment should not be taken lightly: these images have the potential to inform public debate and opinions (Elliot & Rosenberg, 1987); they can “influence the choice of public policies and the methods for carrying them out” (McCurdy, 1995, p. 500);

and they can inspire or deter young people from pursuing a career in science (Halbfinger, 2005; Shirley & Howle, 2004; Tulloch & Jenkins, 1995). This last influence is especially significant—industries dependant upon scientists and engineers are facing a crisis—the sharp decline of student interest in science and engineering has been well documented (NSF, 2002; Osborne, Simon & Collins, 2003). Unless these fields become suddenly popular with students, this decline will result in a shortage of science and engineering professionals (Halbfinger, 2005; Lambourne et al., 1990; Shirley & Howle, 2004). The reasons for study are numerous and clear, and the limited scholarly attention toward science in science fiction entertainment has left a virtually uncharted territory waiting to be explored.

While several studies have explored the representation of scientists in literature and films (Comstock & Tully, 1985; Goldman, 1989; Hirsch, 1958; Lambourne et al., 1990; Lambourne, 1999; Sobchack, 1999; Skal, 1998; Todor, 1989; Toumey, 1992; Weingart, 2003), there is almost no research examining the portrayals of science and scientists in science fiction television programs. The increasing popularity of science fiction television shows makes this an important area of study for science communications scholars attempting to ascertain the influences of mass media on public perception and understanding of science. Although there is some research exploring science on television in general (Gerbner, 1980, 1981, 1985, 1999), the most recent study done in 1999 is an unpublished government report looking solely at primetime television. When considering the changes in science fiction television programming and content over the past decade (Parks, 2000) coupled with Gerbner's focus on primetime television, it is impossible

to say whether his findings in earlier studies are descriptive of the science and scientists in modern¹ science fiction television shows.

In order to explore this uncharted territory of modern science fiction television, this study will look at the science and scientists in popular science fiction television shows. The goal is to answer questions about how science and scientists are represented. A content analysis will examine various aspects of the science and scientists in programs produced and aired during the last two decades (1987-2007). Related research about the science in science fiction literature and Hollywood films serves as a guide for the research questions asked here and also provides the basis for making historical comparisons. Research in cultivation theory and science literacy serves as a foundation for discussions about the potential impacts and possible benefits of these fictional images of science and scientists.

¹ For the purpose of this study, the term ‘modern’ refers to science fiction television shows that were produced during the last two decades, 1987-2007, and the run of their associated television season began no earlier than January 1, 1987 and no later than December 31, 2007.

CHAPTER 2 REVIEW OF LITERATURE

Defining ‘Science’ ‘Scientists’ and ‘Science Fiction’

In a study primarily focused on content in science fiction, it is important to have a basic understanding of the terms ‘science,’ ‘scientists’ and ‘science fiction’. According to the Merriam-Webster dictionary, science is defined as:

- 1) Knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through scientific method.
- 2) Such knowledge or such a system of knowledge concerned with the physical world and its phenomena.

Merriam-Webster dictionary defines a scientist as:

- 1) A person learned in science and especially natural science.
- 2) A scientific investigator.

For the purpose of this study, the presence of science and scientists in a television show was primarily defined by the practice or discussion of traditional and easily identifiable sciences such as astronomy, physics, geology, biology, etc. More specifically, this study defines science and scientists as follows:

- Science is an organized body of knowledge attained through a system of observation and experimentation, which is used to describe and explain the physical world natural phenomena.
- Scientists are any individual who has attained and practices a professional level of expertise in any social or physical science.

Similar to the terms ‘science’ and ‘scientists,’ there is no shortage of definitions for the term ‘science fiction.’ The problem lies in finding two definitions that are in agreement.

According to Webster’s Universal Encyclopedic Dictionary (2002) the term ‘science fiction’ originated in 1851 and is defined as “fiction dealing principally with the impact of actual or imagined science on society or individuals or having a scientific factor as an essential orienting

component” (p. 1640); scientist and author Paul Davies defines science fiction as “a literary device for conducting a type of theoretical science” (as cited in Lambourne et al., p. vii); and science fiction anthologist Edmund Crispin defines science fiction as a story that “presupposes a technology, or an effect of technology, or a disturbance in the natural order, such as humanity, up to the time of writing, has not in actual fact experienced” (as cited in Gökçe, 1996). Science fiction authors Sam Moskowitz and Donald A. Wollheim, present two coherent and similar definitions:

- 1) Science fiction is a branch of fantasy identifiable by the fact that it eases the "willing suspension of disbelief" on the part of its readers by utilizing an atmosphere of scientific credibility for its imaginative speculations in physical science, space, time, social science, and philosophy (Moskowitz, as cited in Gökçe, 1996).
- 2) Science fiction is that branch of fantasy, which, while not true to present-day knowledge, is rendered plausible by the reader's recognition of the scientific possibilities of it being possible at some future date or at some uncertain point in the past (Wollheim, as cited in Gökçe, 1996).

A combination of the concepts outlined by Muskowitz and Wollheim provides a simple and concise definition of science fiction:

- Science fiction is the use of scientific credibility and plausibility as a central element of the events, societies and technologies depicted in the stories and plots.

However, in order to explicitly define a science fiction television show for the purpose of an applied study, it is necessary to further limit what will and will not be considered science fiction.

Science fiction is a genre with a long history of traditional themes. These themes provide a simple and effective way to provide a more precise definition of a science fiction television show. Some traditional science fiction themes include space travel and exploration, time travel, alternate dimensions or realities, futuristic societies and technologies, super-humans, aliens and robots. A comprehensive list of themes and sub-themes was published in *The Visual Encyclopedia of Science Fiction* in 1978. Frequently cited by other science fiction researchers

(Lambourne, Shallis & Shortland, 1990), this list of themes and sub-themes will contribute the final concept necessary for a comprehensive and explicit definition of a science fiction television show.

To be considered a science fiction television show in this study, the show must fulfill two prerequisites:

- 1) Scientific credibility and plausibility are a central element of the events, societies and technologies depicted in the stories and plots.
- 2) At least one traditional science fiction theme or sub-theme¹ is evident.

History of Science Fiction Television

Communications scholar Jeffrey Sconce (n.d.) places the beginning of science fiction television in the late 1940s. Early science fiction programming was generally aimed at children. Programs like *Buck Rogers* (ABC 1950-51) and *Flash Gordon* (Syndicated 1953) catered to a young audience (Sconce, n.d.). The 1950s saw a rise in science fiction programming aimed at the adult audience; several researchers associate the rising popularity of 1950s science fiction with the sociopolitical environment of the Cold War and Kennedy's "New Frontier" (Sconce, n.d.; Tulloch & Jenkins, 1995). Some of the most notable programs of the 1950s and 1960s era were *The Twilight Zone* (CBS 1959-64), *The Outer Limits* (ABC 1963-65) and *Lost in Space* (CBS 1965-68) (Sconce, n.d.). Then, in 1969 after a three-year run, an expensive science fiction program that failed to attract large audiences was canceled; it would go on to become one of the most recognizable television shows and franchises of all time—*Star Trek* (NBC 1966-69) (Lambourne et al., 1990).

Even though *Star Trek* and the BBC show *Dr. Who* (1963-1989) demonstrated that there was a large and loyal audience, science fiction television experienced a decline during the 1970s

¹ For complete list of themes see Appendix A, Definitions, Science Fiction Themes and Sub-themes

and into the 80s (Sconce, n.d.), but changes were on the horizon. The incredible success of George Lucas' *Star Wars* (1977) inspired the use of complex special effects in science fiction television. *Battle Star Galactica* (ABC 1978-80) was one of the first shows to bring *Star Wars* style special effects to the small screen; *Galactica's* producers invested heavily in special effects to enhance the realism of their show (Burns, 2001; Sconce, n.d.). This event transformed science fiction on the small screen—television audiences could now experience the dazzling special effects of Hollywood films without leaving their living room. What Sconce (n.d.) calls the “most pivotal series in rekindling science fiction,” took full advantage of the advancements in special effects technologies; a series that “quickly became the highest rated syndicated show ever”—*Star Trek: The Next Generation* (Syndicated 1987-94). *Star Trek: The Next Generation* was a catalyst for the future of science fiction television in more ways than one; at a time when science consultants were a rarity on a television set, *Star Trek* creator Gene Roddenberry employed physicist and engineer Naren Shankar to improve the scientific authenticity of the shows scripts (Kushner, 2005). Although *Star Trek: The Next Generation* delivered a demographically diverse and loyal audience, the three major networks generally avoided science fiction through the 1990s (Sconce, n.d.).

Ignored by networks, science fiction television programs continued to grow in popularity attracting larger and more diverse audiences, and in turn, producers and advertisers (Sconce, n.d.). In 1992, the Sci-Fi Channel debuted as a new cable network airing mostly movies and television re-runs (Sconce, n.d.). With the success of science fiction shows like *The X-Files* (1993-2002) and *Babylon 5* (Syndicated 1994), the audience for science fiction television was expanding fast. In the late 1990s the Sci-Fi Channel began producing original programming; in 2004 they announced their third consecutive year of climbing ratings and reported that 2004 had

been the “most-watched” and “highest-rated” year since the channel’s debut in 1992 (Sci-Fi Channel, 2004). By 2007 the Sci-Fi Channel was airing 12 original series and 29 syndicated science fiction programs (Sci-Fi Channel, 2007).

The international success of the Sci-Fi Channel proved there was a substantial audience for science fiction television. An article in *The New York Times* (2004) reported on this success, citing ratings for the hit Sci-Fi Channel original series *Stargate SG-1* (1997-2007); *Times* journalist Anita Gates described the show as a “worldwide phenomenon,” reaching 17 million viewers a week in 64 countries around the world, and reportedly “the No. 1 show in Britain, France and Germany with the 18-to-44 set” (p. 4). The unprecedented, worldwide success of *Stargate SG-1* may have played a part in luring major networks back to the science fiction genre—an audience of 17 million viewers is difficult to ignore in a business dependent upon advertising dollars. In 2004 ABC launched the show *Lost*, and in 2006 NBC launched *Heroes*; the unexpected success of these science fiction and paranormal themed shows caused an explosion in science fiction programming that was no longer limited to cable (Frutkin, 2007; Keveny, 2004; Umstead, 2007). Science fiction television now holds a primetime position in both its volume and reach. Fictional images of science and scientists are reaching millions of viewers around the world; if the science fiction programming and audience trends of the last two decades continue, this number will increase. This abundance of science fiction programming begs the question, what kinds of messages about science and scientists are these fictional images sending out to millions of people every week?

The Power of Images

As most people do not have personal interactions with science and scientists, they get their science information from mass media (Nelkin, 1995). Because personal experiences of

science are out of reach for most people, the images provided by media are especially powerful in shaping public perceptions of science (LaFollette, 1998). Historian and film scholar Robert Rosenstone (2003) says the power of a single image in a narrative is often more potent and more memorable than the story as a whole (p. 336). Images create metaphorical truths about an intangible world of science (Rosenstone, 2003). Based on Rosenstone's assertions, in the absence of direct personal observation, these metaphorical truths become reference points for scientific concepts. For example, the terms *hyperdrive* and *hyperspace* have become synonymous with the concept of interstellar travel (Lambourne et al., 1990). While most people cannot explain the science behind traveling at the speed of light, they do recognize a 'jump to hyperspace' in television will be shortly followed by the special effects of moving forward into a blurring tunnel of stars. Entertainment media has created this universal image of what it looks like to travel at the speed of light. Visual images are powerful defining elements for people who have only virtual access to science; an access that is granted by a middle-man—the medium. In this study, that access-granting medium is television.

As the middle-man providing the public with virtual access to science, the media interpret science information for public consumption. Not surprisingly, science communications scholars cite news as the dominant source for public science knowledge and information (Elliott & Rosenberg, 1987; Nelkin, 1995; Treise & Weigold, 2002). And according to the National Science Board (2006), Americans cite television as their main source for information about science and technology, but science stories make up only two percent of network news broadcasts (Project for Excellence in Journalism, 2004). Entertainment programming is far more prevalent and has a much larger audience than news (*TV Dimensions*, 2003, p. 239), yet entertainment has not previously been a focus point for most science communications scholars (Kirby, 2003a;

Lambourne et al., 1990; Weingart, 2003). Given the multitude of fictional science images being fed to a global television audience on a weekly basis, it seems logical to scrutinize these images as an influence on public perceptions of science.

Representations of Science in Film and Television

Background research revealed no previous scholarly studies looking specifically at portrayals of science and scientists in science fiction television programs. For this reason, most of the existing research referenced in this study comes from scholars looking at general portrayals of science in film and literature, and portrayals of politics and crime in television.

The only research explicitly related to science and scientists on television was done in the 1980s and late 1990s by Gerber, Gross, Morgan, and Signorielli. The results of their research will be discussed briefly in conjunction with cultivation theory, but because most of the studies were conducted more than 20 years ago and did not look specifically at science fiction television, they cannot be considered representative of the science and scientists in modern science fiction television.

Three anomalous scholars are responsible for the most notable recent research of science in entertainment media in general: David Kirby (2003a, 2003b, 2003c), Robert Lambourne (1990), and Peter Weingart (2003). Interestingly, this limited body of research is a result of scientists and sociologists, not science communications professionals. While Kirby is currently a lecturer in science communications at the University of Manchester, he holds his Ph.D. in Molecular Evolutionary Genetics. Lambourne is an author and lecturer in Physics at the Open University, and Weingart is professor of sociology, sociology of science and science policy at Bielefeld University in Germany. Even though the examination of science and scientists in entertainment remains largely unexplored by science communications scholars, the research of

Kirby, Lambourne, and Weingart provides a good starting point for examining these topics through the lens of science communications.

David Kirby: Science and Science Consultants in Film

Kirby (2003a) focuses his research on the impact of science consultants and advisors on Hollywood films. He posits that “film naturalizes both ‘accurate’ and ‘inaccurate’ science by presenting both as ‘natural’ via a perceptually realistic framework” (2003a, p. 261). Noting that many scientists believe the public’s understanding of science is negatively affected by the fictional representations of science in film and television (p. 262), Kirby’s research suggests that the use of science consultants in films may not necessarily improve public understanding of science, but they can help to improve the “public appreciation of science” (2003a, p. 274).

This public perception and appreciation of science have become a concern for scientists who believe that funding for science research is connected to public opinions of science and scientists (Kirby, 2003b, p. 57). Kirby also posits that because film and television are “highly visual and rhetorically persuasive media,” these mediums can influence “scientific epistemology” (2003c, p. 232). Through the “virtual witnessing” made possible by film and television, viewers can have seemingly “real” experiences—experiences that can contribute to scientific epistemology. (2003b, p. 55).

In further discussing the potential influence of science images in film and television, Kirby points out the important distinction between realism and plausibility, citing the work of Barker and Brooks (1995) who found that “audiences make judgments about what is ‘plausible’ ...not necessarily what is ‘real’”(2003b). According to Padian (1987), the power of images “to become fixed in the minds’ eye” relies on plausibility not accuracy (as cited in Kirby, 2003b, p.56). As one of the only scholars dedicated to researching the presence of science in

entertainment media, Kirby's work emphasizes the importance of understanding how fictional films influence scientific practice and public perceptions of science. He brings together the concepts of naturalizing fictional science, virtual witnessing, and plausibility, to demonstrate that entertainment media have the power to exert great influence.

Robert Lambourne: Science in Science Fiction

As a physicist, the majority of Robert Lambourne's work is not related to science communications or entertainment media. However, his book, *Close Encounters? Science and Science Fiction* (1990), co-authored by Michael Shallis and Michael Shortland, is one of the most frequently cited texts on the subject of science in science fiction film and literature. Lambourne's book (1990) coupled with a book chapter on "science fiction and the communication of science" (1999), offer a detailed look at science fiction in films and literature, as well as a discussion of the science in science fiction.

Lambourne, Shallis and Shortland look primarily at films from the 1950s, 1960s and 1970s, saying that scientists in films of the 1950s shed their 'mad scientist' image for a more clean-cut and logical-minded 'regular guy' image (1990, p. 101). They note that fictional portrayals of scientists have become "naturalized"—they are no longer instantly distinguishable from other characters—they have been "domesticated" (p. 101). Despite this trend, "science is portrayed as alarming and reassuring, as of great benefit but potentially of great harm," the "regular guy" scientists may crack at any moment under the pressures of his fictional profession (p. 106). The authors point out the confusion created by these mixed messages about science and the scientists. The contradicting images of science and scientists that are both beneficial and harmful help create an element of uncertainty. While this element can be useful in entertainment—keep the audience guessing—in communicating science to the public, the

element of uncertainty is a well-documented problem (Zehr, 1999). Without further research into science fiction entertainment, it is impossible to say whether these confusing and mixed messages are contributing to public scientific uncertainty, or merely reflecting it.

Lambourne, Shallis and Shortland provide valuable insight into the images of science and scientists in film and literature, but it is important to note that their examination of film was almost entirely limited to films of the 1950s, 1960s and 1970s. Modern science fiction television comes out of a vastly different social, political and technological climate than that of the 1950s, 1960s and 1970s. Their historical research will provide a foundation for examining any changes in the characterizations of science and scientists over time. Whether or not their “domesticated” scientists and harmful science can be seen 21st century science fiction television is a question that has yet to be answered.

In a more concise look at the actual science in science fiction, Lambourne’s book chapter discusses the settings for science in science fiction and the types of sciences being portrayed (1999). Lambourne cites several fictional settings that foster the communication of science in science fiction: “purpose of science, the process or science, the character and experience of scientist, or the historical, political and sociological aspects of science, including its impact on society” (p. 147). He also points out several clues that help to identify the actual science that takes place in various settings, such as the filmmaker interrupting the story “to explain the nature of dinosaur DNA,” or to explain the elements of an “Einstein-Rosen bridge” (p. 146). With regards to the types of science taking place, Lambourne cites previous research (Nicholls, 1983; Lambourne, 1990), which found that physics, astronomy (including planetary science), space exploration and some biology (molecular, genetics and ecology) dominate science fiction stories, while earth science and chemistry make only rare appearances. Of particular significance to this

study, Lambourne predicts that a more recent examination of science fiction will find a significant increase in the number of stories about information technology and computer science. By answering a research question about the most frequently portrayed sciences in science fiction, this study will either prove or disprove Lambourne's prediction.

Part of examining the communication and presence of science in science fiction involves recognizing the actual science. According to Lambourne, recognizing "true" science is often complicated by the inclusion of *imaginary science*—science that appears authentic through the use of scientific jargon and presentation (p. 150). Most often *imaginary science* serves to push the story forward, and while *imaginary science* does not communicate real science, it can prepare the consumer or audience to better "recognize definitions of real science" (p. 151). Ultimately, any science content in science fiction has the potential to communicate the processes and methods of real science.

Peter Weingart: Science and Scientists in Film

The only recent scholarly study including a look at more modern films was done by Peter Weingart in 2003. A quantitative analysis of 222 films from eight decades produced results detailing gender, ethnicity, character and appearance of film scientists, which scientific disciplines were most frequently portrayed, and representations of scientific work, secrecy, knowledge and ethics.

Weingart's findings suggest, that overall, the portrayals of science and scientists in the movies are characterized by "uneasiness" and "distrust" (p. 281). Weingart also found "the creation and manipulation of life" to be a dominant theme (p. 286). These findings provide little new information—both assertions have been documented by other studies of science in film and literature (Frayling, 2005; Gerbner, 1987; Kirby, 2000). A more interesting finding from

Weingart's study is what he described as the "distance of society from its science" (p. 286). In addition to looking at characterizations, Weingart tracked where the science was taking place, noting that 25% of the scientists in films were "off the planet," one-sixth were "eccentric" and only about 5% were "comical"; he claims these characterizations contribute to the "distance" between the lay person and science (p. 286). Also of notable significance, Weingart found horror to be the dominant genre for films about science, and comedies to be the weakest—with very few science-themed movies falling into the comedy genre (p. 286).

Even though Weingart's study looks at film instead of science fiction television, as of 2007 it is the most recent scholarly study of science and scientist portrayals in an entertainment medium; this makes it the most relevant research to use as a basis for comparing findings from this study of science fiction television. This study will replicate some of Weingart's points of investigation, such as the types of science taking place. A comparison of his findings with the results of this study could produce some new and relevant insights into the representations of science and scientists in film versus television. It will be especially interesting to see if science fiction television shows exhibit the same characterizations of scientists. If these elements are similar, then perhaps science fiction television shows are contributing to Weingart's "distance" between science and the public.

Politics and Crime in Television

Researchers in many other fields have recognized television as a potential hotbed of influential images and ideas. For example, scholars have been examining the effects of fiction on public administration for more than fifty years (McCurdy, 1995). To gain further understanding of the potential effects of television images and messages on viewers, it is useful to briefly review a few studies from other disciplines.

In 2005, political communications scholars Holbrook and Hill conducted a study of television crime dramas; they found that frequent viewers of crime dramas had increased concerns about crime, which in turn had a significant negative influence on their overall approval of President Bush. The authors believe this influence can be attributed to the priming affect of crime dramas—“priming judgments about the President’s performance on crime,” and also by creating specific expectations about how crime should be handled (Holbrook & Hill, 2005, p. 9).

In another political communications study Holbert, Shah and Kwak (2003) analyzed primetime dramas and sitcoms to study the relationship between images in television and audience opinions about women’s rights; they found a statistically significant relationship between entertainment television use (traditional drama, progressive drama and situation comedy) and opinions about women’s rights. In yet another politically related study, Pfau, Moy and Szabo (2001) showed that watching science fiction television programs contributed to a more negative perception of the federal government. However, it is prudent to note here that the most frequently cited science fiction show in their study was the *X-Files*—a program whose central premise is government conspiracy and cover-ups.

Political communications has been particularly attentive to the potential influences of television, but researchers in other areas have also given a nod to the power of images on the small screen. As one example, children’s media researcher Katherine Heintz-Knowles (2000) studied images of youth in primetime television to determine what messages about youth are being sent out to American audiences. She found that TV youth are not an accurate representation of actual U.S. youth demographics, and that “TV parents are most often shown as absent or ineffective” (p. 6). Heintz-Knowles (2000) notes these images not only reflect current social and cultural beliefs, but also “influences on newly forming belief systems” (p. 22). The

abundance of research by other scholars on the images and impacts of television entertainment suggests that it is indeed an important and valid subject for study; mass media images are powerful, prolific and widely accessible.

Cultivation Theory

Communications scholar George Gerbner believed that we experience much of what we know through stories, and that stories “socialize” us into the roles we take on in life (in Shanahan & Morgan, 1999). Considered the father of Cultivation Theory, Gerbner claimed the three significant functions of these stories that “animate our cultural environment” are: “(1) they reveal how things work; (2) they describe what things are; and (3) to tell us what to do about them” (in Shanahan & Morgan, 1999, p. ix). According to Gerbner, in modern society the media have taken on the role of storytellers. Science communications scholar Sharon Dunwoody agrees: “Global culture relies on storytelling as arbiter of what is important and what is not. Mass media reign as our principal storytellers on the cusp of the 21st century” (in Friedman, Dunwoody & Rogers, eds., 1999, p. 61). If society is shaped by stories as Gerbner posits, and the media is our “principal storyteller” as Dunwoody suggests, then the content of those stories is certainly worthy of examination.

In the 1960s Gerbner began his Cultural Indicators Project to examine the effects of television’s storytelling role (Greunke, 2000). In 1976 Gerber demonstrated a connection between frequent television viewing and unrealistic beliefs about the prevalence of violence in the real world, asserting that, over time media cultivate attitudes and perceptions by repeatedly exposing viewers to the same types of messages communicated through imagery and stories (1994). Cultivation theory suggests heavy viewers are more susceptible to the cumulative influences of media messages—the more science fiction a person watches, the more messages

about science and scientists they receive, and the more likely it is that those messages will influence their attitudes and perceptions about science. With the science fiction television audience growing by leaps and bounds, this study aims to examine those messages.

While much of Gerbner's cultivation research has focused on crime and drama, several studies have examined representations of science in primetime television shows (Gerbner et al., 1981, 1985; Gerbner, 1987; Gerbner & Linson, 1999). In 1981 Gerbner studied images of science on primetime television as part of the ongoing Cultural Indicators Project. The study found that six out of ten primetime dramatic programs featured science, technology or engineering themes, but science was the main focus of only four percent of primetime programs overall. While science themes were not exclusive to one genre, they were "slightly more frequent in serious and action dramas than in comedies," resulting in a greater likelihood that science is connected to violence (p. 41). Continuing his research of science on television, in 1987 Gerbner found that a viewer's heaviest exposure to images of science and scientists occurs on primetime dramatic programs, not news and documentaries. The same study found that frequent viewers were more likely to have negative perceptions of science and scientists; negative perceptions were characterized by a general mistrust of science, and beliefs that science was dangerous (1987). These studies also found that heavy viewers perceived careers in science as undesirable; a finding of considerable concern given the decline of student interest in science and engineering careers (NSF, 2002; Osborne, Simon & Collins, 2003). Pertaining specifically to scientist characters, in a study of 1,500 television viewers, Gerbner and Linson (1999) reported that the more television people watched, the more they perceived scientists as "odd and peculiar" (as cited in National Science Board, 2002). Additionally, between the years 1994–1998 less than 2% of characters on primetime television were scientists, and 75% of those

scientist characters were white males (National Science Board, 2002). While these findings are specific to primetime television, it will be interesting to see if scientist characters in science fiction television are also predominantly white males.

These four studies into the images of scientists and science on primetime television have been repeatedly cited by National Science Board reports in discussions of science literacy and public understanding of science (2002; 2004; 2006; 2008). Gerbner's cultivation research is also widely cited by studies making a case for the potential influences of television on public perceptions of science (Barnett et al., 2006; Kirby, 2003; Rose, 2003; Weingart et al., 2003). Ultimately, these references to Gerbner's research all stress the same central point, which serves as a concise summation of Gerbner's research of science on television: over time, the dominant images of science on entertainment television have the power to cultivate public beliefs and perceptions of science.

While hundreds of studies have employed cultivation analyses, cultivation theory has been criticized for several reasons, most frequently for being "oversimplified"—disregarding the complicated nature of the human psyche and the power of other social and cultural influences (Casey, Casey, Calvert, French & Lewis, 2002; Greunke, 2000). Realistically, cultivation analysis can establish a correlation between watching television and perceptions of reality only after accounting for other confounding variables such as race, gender, education, occupation, etc. (Casey et al., 2002). Despite the criticisms, the trend in U.S. cultivation analyses has been that findings do confirm the hypotheses (Casey, et al., 2002). The support for cultivation theory far outweighs the criticism.

Public Administration professor Howard McCurdy is one example of a scholar whose research supports the concepts of cultivation theory; he notes that fictional images related to

public policy send messages that influence people's attitudes (1995). McCurdy claims that "public policies change when people alter their images of them" (p. 504). His historical research demonstrated how imagination and fiction can come together and "reshape the public consciousness, which in turn become part of the knowledge base for making policy decisions" (p. 502). McCurdy cites Hollywood science fiction films as communicating the importance of the space program in the 1950s, claiming that Hollywood's images provided the foundation for the "ambitious space program adopted by the United States and the system of administration necessary to carry it out" (p. 501). One such film discussed by McCurdy is *Destination Moon* (1950). The film reflects the sociopolitical climate of the cold war, highlighting the importance of beating the Russians to space and winning control of the moon. The film, currently discussed in NASA's History Series (Millbrooke, 1998), also included a Woody Woodpecker cartoon that was used by NASA to introduce a 1950s public to rocket science and space travel (Frayling, 2005). McCurdy notes that the strong support for beginnings of the U.S. space program was heavily dependant upon public images of space and the Cold War (p. 505), images that were abundant in films like *Destination Moon* (1950) and *The Day the Earth Stood Still* (1951) (Lambourne et al., 1990). In examining science fiction history, several scholars have made this connection between science fiction films and television of the 1950s and Cold War ideologies (Sconce, n.d.; Tulloch & Jenkins, 1995). McCurdy's findings, coupled with historical examinations of past science fiction television, suggest that characters and portrayals of science in science fiction are closely linked with the current sociopolitical climate in which they are written and produced. Results from this study may provide some insight into whether or not this is true of science fiction television from the last two decades.

In considering cultivation theory in a study of science and scientists in science fiction, there are three key elements to highlight. First, is the element that the effects of cultivation are cumulative, and the most persistent influences are a result of recurring images over long periods of time; second, that those influences will manifest as ideas, beliefs and perceptions, rather than behavior; and third, is the element of mainstreaming (Casey et al., 2002). The concept of mainstreaming, which came out of political communications research, argues that in the absence of a wide array of images of messages, a small pool of images and messages “narrows the range of opinions people are inclined to hold” (Casey et al., 2002, p. 51). If a pool of homogenous images and messages about science dominate science fiction television shows, it could perpetuate a narrow view of science and scientists; these three key elements could be contributing to perceptions about the gender and character of scientists, the nature and benefit of scientific work, the process of doing science, and the appeal of science as a career choice.

Coming back to Gerbner’s concepts of stories and story-tellers, it is important to note that whether intentionally or unintentionally, stories do communicate images and concepts of science, but “stories have their own rules” that can affect the meaning of what is being communicated (Rosenstone, 2003, p. 338). As noted in a study by Holbrook and Hill (2005), the line between entertainment and information is blurring, a concept reaffirmed by LaFollette (2002) in a concluding statement about her survey of science content in 1940s and 1950s television; LaFollette points out that as early as the 1940s and 1950s “fact and fiction had begun to merge comfortably in the world of television” (67). Science fiction television is a prime example of a genre where the mixing of fact and fiction—accurate versus plausible, creates mixed messages about the real world of science and scientists. Not only can these fictional images of science influence perceptions by way of cultivation and mainstreaming, but there is considerable

evidence that science fiction also communicates real science and can impact science literacy (Cavelos, 2000; Desalle & Lindley, 1997; Dubeck et al, 1988, 1993, 2007; Krauss, 1995; Lambourne, 1999; Simon, 1999).

Science Fiction, Science Literacy and Perception of Science

According to the National Education Standards (1996), scientific literacy is

“the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity” (NRC, 1996, p. 22).

Science and science fiction have many things in common, most predominantly, they both have a strong foundation in one question: What if? (Casey et. al 2002; Czerneda, 1999). While science fiction narratives are often based on the present, they look to the future, and explore space-time travel and alternate dimensions as a basis for debate about what the future might be like (Casey et al. 2002). This function of science fiction creates situations where students and viewers alike can debate various ‘what if?’ scenarios.

The possibilities born out of this question have lead many science teachers to utilize science fiction as a method for teaching sciences and improving science literacy among their students. Since the 1970s science fiction has been used by teachers as a tool for increasing science literacy (Czerneda, 1999; Cavanaugh & Cavanaugh, 1996; Dubeck, Moshier, & Boss, 1988; Efthimiou & Llewellyn 2004; Fraknoi, 2003; Martin, 1979; Negrete & Lartigue, 2004; Reynolds, 1977; Rose, 2007; Zander, 1974). There are several reasons for this use of science fiction in classrooms across the country, including: science fiction has the ability to capture the imagination and attention of its viewers; it allows a virtual witnessing of science processes and methods that help ground science in reality; complex scientific concepts are more easily explained and readily remembered when associated with images and/or a story (Czerneda, 1999;

Dubeck, Moshier, & Boss, 1988; Rose, 2007). As Czerneda (1999) explains in her book, *No Limits: Developing Science Literacy Using Science Fiction*, the concepts and terminology in science fiction stories, whether fictional or not, build a familiarity with real scientific processes and terms, and because recognizing the words and vocabulary of science is a necessary component of scientific literacy, science fiction is an excellent tool for developing that literacy. Another characteristic of a scientifically literate person, is that they are able to distinguish between “what is and what is not a scientific idea” (Caerneda, 1999, p.2). Not only do the imaginary elements in science fiction create a foundation for recognizing science in everyday life, the stories also build the critical thinking skills necessary to discern between real and imaginary science.

A popular use of science fiction in the classroom is to prompt students to find the imaginary science and explain why it is imaginary and not real (Dubeck, Moshier, Bruce, & Boss, 1993). Dubeck (1988, 1993, 2007) is a strong proponent of using science fiction films to increase science literacy, claiming that the images in science fiction films visually demonstrate “abstract scientific principles,” which then increases student understanding and fosters a positive attitude towards science (1988, p. xii). Other scholars note one of the greatest benefits of using science fiction in the classroom is its ability to provide a link between the humanities and the sciences (Wilson, 1980; Zander, 1975). Despite these many declarations of support for science fiction in the science classroom, the real proof of viability lies in the studies that have put the academic usefulness of science fiction to the test.

Over the years a variety of studies, encompassing various methods, have shown science fiction to impact student science literacy and interest in science. In 1974, a Texas State University reported an increase of non-science majors enrolling in a physics course after science

fiction was introduced into the course curriculum (Zander, 1975). Ongel-Erdal, Sonmez & Day (2004) examined the relationship between student interest in science fiction and scientific ability; they found that “the more students were interested in science fiction movies, the more they seem to understand the scientific process and determine scientific concepts correctly” (p. 5), but the authors do note the possibility that students who are more interested in science fiction may also be more interested in science, and therefore be more scientifically literate. Efthimiou & Llewellyn (2004) designed and taught a course called Physics in Films; based on the student reported satisfaction, grades, and general performance of over 1,600 enrolled students, they found that using film to teach physics improved student understanding, interest and enjoyment of the subject.

Researchers have shown that science fiction paired with science education can increase science literacy and student interest, but science fiction can also produce misconceptions. In 2006, a study published by the *Journal of Science Education and Technology* tested the affect of a single science fiction film on student perception and understanding of earth science—the dominant science featured in the film. Barnett et al. found that viewing *The Core* did influence student’s perceptions and understanding of earth science (2006). The 2003 film *The Core* is a fictional narrative about scientists trying jump start the Earth’s inner core, which has stopped spinning, and, consequently is causing the electromagnetic field around the Earth to disappear. Conducted over a four week period, the study surveyed 82 eighth graders all enrolled in the same science class taught by the same teacher. Some students were interviewed both at the start and end of the four-week Earth sciences section of their class. In addition to the interviews, the researchers used pre-post multiple choice and content based tests. Of the 38 students included in the post-interviews, 22 watched *The Core*, and 16 did not. Students who did not watch the film

were more likely to correctly answer a question about the earth's magnetic field than the students who did watch the film. Students who did watch the film were able to discern between some of the real and unreal science, but tended to believe most of the film's science to be real, or close to real, when it was presented by credible characters in credible settings—such as a scientist or professor in a lab or classroom. These findings suggest that on its own, science fiction film and television can create misconceptions about science, and confirms the assertions that science fiction blurs the distinction between fact and fiction (Frank, 2003; Sconce, n.d.).

Aside from the popularity of science fiction in science classrooms, compelling evidence demonstrates that fictional images of science can influence public perceptions and attitudes about science (Gerbner et al., 1980, 1981, 1985, 1987; Elliot & Rosenberg, 1987; LaFollette, 1998). The ability of film and television to present realistic images of situations and events, results in perceptions of plausibility (Frank, 2003; Rose, 2003; Kriby, 2003a). When the audience sees realistic images of dinosaurs sharing the screen with scientists who lend their status and credibility to explanations of dinosaur DNA from a well-preserved mosquito (*Jurassic Park*, 1993), the scenario is so realistic, and so steeped in scientific explanations, that it becomes plausible in the minds of the audience. As cited by Kirby (2003a), the audience makes a decision between what is real, and what is plausible; when something is plausible, it walks that blurring line between fact and fiction.

Contributing to the blurring of this line is the flexible nature of the science fiction genre; science fiction does not operate within the confines of “naturalistic or realistic conventions” – its content is more often symbolic, making it an ideal platform for presenting alternative social, cultural and political views (Casey et al., 2002). Even though story lines and plots may be taking place on distance worlds inhabited by alien beings, the messages can be interpreted as something

far more familiar and symbolic of present cultural, social and political realities (Casey et al., 2002). Casey cites the television series *Dark Skies* (1996-1997) as one example of a science fiction show that used the flexible nature of the genre to explore changing gender roles. Several scholars discuss the ways in which science fiction has tackled sensitive social and political issues (Czerneda, 1999; Lambourne, 1990; Sconce, n.d.). Perhaps the most notable example of a single show is *Star Trek*. The original series symbolically represented and debated issues of gender and racial prejudice; for instance, in the midst of 1960s racial tensions, *Star Trek* producers cast a young African American woman into a prominent role as one of the main crew members aboard the Starship Enterprise (Sconce, n.d.). Lambourne (1990) also notes several films of the 1950s that played an important part in shaping public perceptions of science and scientists during a time when technology was rapidly advancing. Films like *Destination Moon* (1950), *The Day the Earth Stood Still* (1951), *Invasion of the Body Snatchers* (1955) and *Forbidden Planet* (1956) served as both a reflection of current sociopolitical climate and beliefs about science, and as catalyst for shaping new perceptions and introducing new technologies (Lambourne, 1990). One reason for science fiction's ability to shape public perceptions could be its foundation in science fact; science fiction begins in fact, and then provides rational explanations for scenarios that go beyond known reality (Casey et. al, 2002). Whether the effects are positive or negative, scholars over the years have argued for and shown clear connections between science fiction, science literacy, and public perceptions of science. The evidence provided by their research adds fuel to that burning question: What messages about science and scientists is modern science fiction television broadcasting to millions of viewers around the world?

Research Questions

A two-part study is required in order to fully understand the potential influences of the images and messages in science fiction television: first, an examination of the content – the images and messages of science; and second, the perceptions and attitudes of the audience receiving those messages. This study fulfills the first requisite—an examination of the science images and messages presented in science fiction television shows. This examination was guided by the following questions:

- 1) What is the dominant gender, personality, characterization, and physical appearance of scientists in modern science fiction television shows?
- 2) Which scientific disciplines are most frequently portrayed in modern science fiction television shows?
- 3) What are the dominant themes in modern science fiction television shows?
- 4) Are scientists and science most often portrayed as beneficial? Or harmful and dangerous?
- 5) How have the science and scientists in science fiction television changed over the last 20 years?

CHAPTER 3 METHODOLOGY

Design

This study used content analysis and followed the “seven steps in content analysis” as laid out by Kaid and Wadsworth (1989). These steps ensure the inclusion and accuracy of all important elements in a content analysis study; (1) Hypothesis and/or research questions, (2) Sampling, (3) Categories, (4) Coders and training, (5) Coding process, (6) Reliability and validity, and (7) Analysis. Content analysis was chosen because it is an established method for the “objective, systematic, and quantitative description of the manifest content of communication” (Berelson, 1952, p.18), and the overarching purpose of this study is to describe objectively and comprehensively the images and representations in science fiction television programming over the last two decades.

The universe included science fiction television shows from both cable and network television that were in production and on-air during the last two decades—1987 to 2007. This time span was chosen for two reasons: first, to include important science fiction television shows like *Star Trek – The Next Generation* and *Amazing Stories*, which were in production in the late 1980s, and second, because the last published content analysis of science in primetime television was done by Gerbner et al. in 1987. Additionally, including two full decades in the universe provides enough material to examine any changes in the representations of science and scientists over time.

Because of the enormous difficulty in trying to assemble year-by-year ratings information provided by companies such as Nielsen, the popularity of science fiction television shows will be based on user rankings rather than commercial ratings. Lambourne (1990) notes the “thorny issue” of trying to explicitly define what qualifies as science fiction (p. X). This is most likely

the reason that background research was unable to produce two databases of user-ranked science fiction television shows that included exactly the same shows, ranked in exactly the same way. While there are several current published lists (Sci-fi Lists, SFTV.org, TV.com, magicdragon.com, Wikipedia), some of which include user ratings and rankings, the content of these lists vary and most are not ideally designed for the purpose of sampling. However, these lists do provide input into the most popular shows among viewers, and, in order to examine the images and messages reaching the largest audiences, two things must be considered: popularity and frequency¹. Several studies, mainly within the discipline of marketing, have found significant connections between the online user reviews and rankings, and the fiscal performance and general popularity of the associated television program or film (Godes & Mayzlin, 2004; Dellarocas, Awad, & Zhang, 2004; Bounie, Bourreau, Gensollen, & Waelbroeck, 2006). Based on this research, online user rankings should provide a reasonably reliable measure of popularity.

After careful research and consideration, Sci-Fi Lists² was chosen as the universe from which to draw the most popular science fiction television shows. This decision was based on several important factors. The author and administrator of the Sci-Fi Lists, Peter Sykes, has taken the time to compile what appears to be the most comprehensive and statistically based list of ranked science fiction television shows on the Internet. Sykes began his list by personally interviewing critics and authors who have published information related to science fiction; Sykes notes that he polled 11 experts, interviewed six published critics, and included information from nine popular polls and 90 other published lists in order to assemble his initial list of ranked science fiction television shows. In order to ensure validity and reliability for the purpose of this study, Sykes was kind enough to share his original correspondences and research used in

¹ For the purpose of sampling in this study, ‘popularity’ refers to user rankings, and ‘frequency’ refers the number of seasons a show aired.

² See Appendix B, Sampling, Sci-Fi Lists Top 100 Science Fiction Television Shows

building his list of science fiction television shows, but asked that the specific content of those correspondences remain unpublished (P. Sykes, personal communication, August 17, 2008). Based on information shared by Sykes, and several personal communications with the author, it was determined that Sci-Fi Lists could be used as a reliable source for assembling a list of the most popular science fiction television shows from the last two decades. Sci-Fi Lists can also be considered representative³ of current user rankings of science fiction television shows because it is regularly updated; this is an added benefit when doing a study of the most popular science fiction television shows at any given point in time. Sykes updates the content of the list and individual show rankings based on user input from emails and votes; he also employs methods to guard against poll-stacking³ (P. Sykes, personal communication, August 17, 2008). It should be noted, that although the list is regularly updated and the shows do move up and down in rank, the movements are very small. Sykes (2008) explained that within the top 50 shows, a show seldom moves more than a few spots up or down in the rankings. The list of top science fiction television shows used in this study was retrieved from Sci-Fi Lists on November 23, 2007. In an effort to ensure the most recent data possible was being used, the researcher compared the list retrieved on November 23, 2007 with an updated list retrieved October 10, 2008 and found that the small rank changes of a few shows did not in anyway change which television shows were included in the final sample of the top 20, this list that was used to compile the final sample of science fiction television shows.

The last, and one of the most important factors in deciding to use Sci-Fi Lists was that it is one of the few lists that is exclusively science fiction and does not include fantasy, sci-fi horror, or non-traditional science fiction television shows. The definition of science fiction set

³ Poll-stacking refers to any attempt by users to manipulate rankings in order to promote certain shows to the top of a list. Most often this manipulation takes place through repeatedly submitting votes for the same show.

forth in this study stipulates that (1) a science fiction television show must use scientific credibility and plausibility as a central element of the events, societies and technologies depicted in the stories and plots, and (2) employ at least one of the traditional science fiction themes or sub-themes as published in *The Visual Encyclopedia of Science Fiction*⁴ (1978). Fantasy and sci-fi horror shows such as *Charmed*, *Buffy the Vampire Slayer* often rely on magic and myths (witches, werewolves, vampires, etc.) rather than science to give credibility to their storylines. These shows do not fulfill the first prerequisite of a science fiction television show. Non-traditional science fiction shows such as *CSI* or *Bones* do fulfill the first prerequisite of a science fiction television show, but they do not fulfill the second prerequisite. Based on all factors discussed, Sci-Fi Lists published by Peter Sykes offered the most comprehensive, accurate and exclusive list of top science fiction television shows available in print or on the Internet.

Sampling

Television Shows

With the goal of including shows that have the largest audiences, it was important that the final ranked list of television shows, which will serve as the sampling frame for the individual episodes, account for both popularity and frequency. With the ‘popularity’ being the user rankings published by Sci-Fi Lists, and ‘frequency’ being the number of seasons, each of the shows was assigned a weighted rank calculated by multiplying the show’s user ranking by the number of years that show was on the air. First, each show was assigned a number based on its rank. For example, *Star Trek: The Next Generation* (Syndicated⁵ 1987-94) was ranked number

⁴ For complete list of themes see Appendix A, Definitions, Science Fiction Themes and Sub-themes

⁵ Several shows in the final sample are first-run syndications, meaning that they were broadcast for the first time as a syndicated show. First-run syndications are made to be sold to programmers other than the major networks.

one by Sci Fi Lists, so the show was assigned the number 10⁶. Second, this assigned number was multiplied by the number of seasons the show was on the air. In the case of *Star Trek: The Next Generation*, the show ran for seven years. Based on this system, the calculation for *Star Trek: The Next Generation* is: 10 (assigned number based on Sci-Fi List rank) X 7 (number of seasons on air) = 70.0, the final weighted rank for *Star Trek: The Next Generation*. Based solely on user rankings from Sci-Fi Lists *Star Trek: The Next Generation* was ranked the number one show, after accounting for frequency (number of seasons), *Star Trek: The Next Generation* ranks third instead of first. This formula was applied to all programs included in the original Sci-Fi List in order to calculate a weighted rank that accounted for both popularity and frequency.

Once a weighted rank was established for all shows, the final sample of television shows was assembled. The sample of science fiction television shows included the top 20 shows based on their weighted rank (see Table 3-1). The sample was strictly limited to American science fiction shows produced between 1987 and 2007, and aired during a television season that began no earlier than January 1, 1987, and no later than December 31, 2007. In order to have consistency in the analysis and to be able to draw comparisons, any animated science fiction shows, such as *Futurama*, were not included in the final sample of shows. After researching each of the top 20 shows included in the final sample, it was determined that each show did fulfill both prerequisites set forth by this study's definition of a science fiction television show.

Episodes

The final sample of the top 20 television shows (see Table 3-1) served as the sampling frame for the individual television episodes, which were the unit of analysis. It was decided to include only the first, middle and last seasons of each show to build the sampling frame.

⁶ The number 10 is an arbitrary number; 10 was chosen because it is a small number and would result final rankings with less integers than if the scale began at 100 or 1000.

Including the first, middle and last season covers the progression of the show from its inception to its end, and, as noted by Sykes (2008) often the middle of a show's run (the middle season) is when the show is at its high-point in terms of ratings and popularity. If a show ran for three or fewer seasons, each season was included in the sampling frame; if a show ran for an even number of seasons, the more recent of the two middle seasons was included in the sampling frame. For example, *Star Trek Enterprise* ran for four seasons, so seasons one, three and four were included in the sampling frame (see Table 3-2). Episodes that aired in early 2008, but were part of a television season that began in 2007, were included in the sampling frame.

The final sample of episodes included two randomly selected episodes from each season included in the sampling frame. Considering the nature of television shows, which are able to develop story lines and characters over time, episodes can vary greatly—shows may air a recap or anniversary episode that is not fully representative of the regular content. For this reason, including two episodes of each show per year provided more accurate information about the characters and portrayals related to science, and also safeguarded against any unusual or specialty episodes skewing the representation of a particular show. Unfortunately, there is no consistency between the starting and ending dates of seasons, making it impossible to sample episodes from the same two random weeks for each show that was on-air during any given year. For example, in the 1997-1998 season, *Stargate SG-1* ran from July 1997 to March 1998, and the *X-Files* ran from November 1997 to May 1998. There are several cases in which not a single week overlaps between two shows that were on-air in the same season (see Table 3-3).

To circumvent this problem, for each show, the episodes aired in each season were numbered according to the week in which they aired. For example, if the episode aired in the fourth week of its show's season, it would be episode number four. Despite the different starting

and ending dates of seasons, which vary greatly between the different shows, most of the included seasons are approximately the same length. For most shows included in the universe, their seasons run somewhere between 18-26 weeks. The final sampling frame from which episodes were selected included a total of 54 seasons; of those, 46 seasons were between 18-26 weeks in length; five seasons were between 11-18 weeks in length; the remaining three seasons were nine, eight and five weeks in length (see Table 3-4). A random number generator was used to randomly select two episodes from each season for each show that was on-air during that season. For example, if the random numbers are 2 and 16 for the 1993-1994 season, then for every show that aired during the 1993-94 season (*Star Trek - The Next Generation*, *The X-Files*, *Babylon 5*, and *Star Trek - Deep Space Nine*), episodes from week 2 and week 16 were included in the final sample of episodes. Because of the previously discussed inconsistency between seasons, the actual dates of week 16 for *Star Trek - The Next Generation*, may not correspond to the dates of week 16 for *The X-Files*; however, for each of these shows their seasons are approximately the same length—at week 16 they are both approximately three quarters of the way through their season. Even though the air dates of individual episodes for week 16 may vary from show to show, the positions of those episodes within the season is the same, and in this respect, carry the same weight in terms of climactic placement within the season.

In five instances it was necessary to generate a second set of smaller random numbers to accommodate the shorter seasons. The researcher does not believe this small deviation had any negative impact on the sampling. It was further decided that no precaution be taken to avoid episodes that may have aired during a sweeps week. The researcher is confident that in a study of science fiction it is extremely unlikely that any show airing during a sweeps week would alter

the findings; science fiction television programs, while they are increasing in numbers, still present little competition to the primetime television shows battling for ratings during sweeps.

Categories

The categories are entirely based on previous research and publications cited in the review of literature. Categories specific to scientists focused on their physical and social attributes. Physical attributes include gender, ethnicity (white, non-white, and/or alien), and appearance, such as glasses, clothing, symbols of knowledge (books, computers, science equipment), attractiveness and average age. Social attributes include type of science performed, morality and ethics (based on actions, honesty/dishonesty and feelings of guilt), personality and characterizations. Personality was coded based on the empirical research done by Goldberg (1993), which established a set of five personality traits: (1) openness; (2) conscientiousness; (3) extraversion; (4) agreeableness; (5) neuroticism. The list of potential characterizations was based on the findings and discussions of numerous scholars (Czerneda, 1999; Frayling, 2005; Lambourne et al, 1990; Lambourne, 1999; National Science Board, 2002; Weingart et al., 2003), and includes common stereotypes such as the mad scientist, the nerd, absent-minded and genius, as well as not so commonly discussed characterizations, such as the hero scientist, the charmer, the comic, and the regular guy/girl.

In addition to the coding categories specific to scientist characters, multiple categories examined the portrayals of science itself—the type of science being done and which traditional science fiction themes⁷ were evident in each episode. The final categories examined the beneficial versus harmful portrayals of science and scientists. For example, is science used to preserve and protect life? Or is there an emphasis on the danger and potential harm of science?

⁷ For complete list of themes see Appendix A, Definitions, Science Fiction Themes and Sub-themes

Coding

A standard coding sheet⁸ served as a guide and reference for the coder, but data was entered directly into an Excel database rather than recorded on paper. By doing this, the database was built throughout the coding process; eliminating the need to enter data after coding increases efficiency and also reduces the potential for errors in data entry. All episodes were coded by the researcher. A trained co-coder experienced in content analysis co-coded a random sample of 10% of the episodes. A detailed codebook⁹ was used to train and guide both the coder and co-coder through the coding process.

Distinguishing real from *imaginary science* on the small screen could be challenging for any researcher or science fiction consumer who does not have some educational or professional expertise in science, and more specifically, the sciences being portrayed in any given episode. During the coding process, recognizing both real and imaginary science depended largely on the use of scientific jargon, processes, settings, tools and the involvement of scientist characters. Both coders have some background in physical sciences and were qualified to identify scientific concepts, principals, and sciences being practiced.

A pre-test was done to uncover any problematic categories or inconsistencies between the coder and co-coder. Only one area presented a significant challenge—identifying the scientists. It was almost always impossible to tell which characters were scientists, particularly if the show was unfamiliar to the coder or co-coder. It was decided the best way to overcome this obstacle would be to research each episode on the Internet and determine who the scientists were, then code those characters as scientists. Because the goal of this study was to determine how scientists are being represented and portrayed, and not to determine whether or not scientists

⁸ See Appendix C, Coding, Coding Sheet

⁹ See Appendix C, Coding, Codebook

could be identified, this was an acceptable method for solving the challenge of coding scientist characters.

All character information obtained from the Internet was verified through multiple sources to ensure accuracy. The most frequently referenced sources were Wikipedia, IMDB, TV.com, and Sci-Fi.com—the official Web site for the Sci-Fi Channel. Any other characters not specifically cited as scientists, but who appeared to be scientists, were either practicing or discussing science, and fit the definition of a scientist¹⁰ as put forth in this study, were also coded as scientists. The fact that scientists were so difficult to distinguish from other characters was an unexpected and interesting finding, and will be discussed further in the next chapter.

After coding the first 10 episodes, it was found that the extent to which science was portrayed varied greatly. It was decided to add an additional category to the coding process. The added category tracked how much science was portrayed in an episode—a lot, some, or very little. ‘A lot’ of science meant that science was prominent throughout an episode, ‘some’ science meant that science was peripheral, and ‘very little’ meant that there was virtually no obvious science in the episode. Once co-coding was completed with the revised codebook and coding process, intercoder reliability was measured by applying Holsti’s Coefficient of Reliability to the co-coded items. The overall Holsti score was .945 with a range of .70 to 1.00 for individual categories¹¹.

Analysis

All analysis was performed in Excel using frequency counts and percentages. Because all coded data was entered directly into an Excel database, and because this study was guided

¹⁰ See Appendix A, Definitions, Scientist

¹¹ See Appendix C, Coding, Intercoder Reliability, for a detailed breakdown of Holsti scores by category

solely by research questions and not hypotheses, performing the analysis directly in Excel was an efficient and accurate method of answering the research questions.

Table 3-1. Final sample of top 20 of science fiction television shows.

Original Rank from Sci-Fi Lists	Assigned Score based on Original Rank	Weighted Rank	New Rank	Series Name	Dates On-Air	# of seasons	Source
3	9.0	90.0	1	Stargate SG-1	1997-2007	10	Show/SF
4	8.5	76.5	2	The X-Files	1993-2002	9	Fox
1	10.0	70.0	3	Star Trek - The Next Generation	1987-1994	7	synd
6	8.0	40.0	4	Babylon 5	1993-1999	5	synd/TNT
10	6.5	45.5	5	Star Trek - Deep Space Nine	1993-1999	7	synd
11	6.0	42.0	6	Star Trek - Voyager	1995-2001	7	UPN
2	9.5	38.0	7	Battlestar Galactica (new)	2003-	4	SciFi/Sky
8	7.0	28.0	8	Farscape	1999-2003	4	SciFi
12	5.5	22.0	9	Stargate - Atlantis	2004-	4	SciFi
23	3.5	21.0	10	Smallville	2001-	6	WB
20	4.0	20.0	11	Quantum Leap	1989-1994	5	NBC
17	4.5	18.0	12	Star Trek - Enterprise	2001-2005	4	UPN
16	5.0	15.0	13	Lost	2004-	3	ABC
24	3.0	15.0	14	Sliders	1995-2000	5	Fox/SF
7	7.5	7.5	15	Firefly	2002-2003	1	Fox
28	2.5	5.0	16	Dark Angel	2000-2002	2	Fox
39	1.0	5.0	17	Andromeda	2000-2005	5	synd
32	2.0	4.0	18	Heroes	2006-	2	NBC
40	0.5	2.0	19	The 4400	2004-2007	4	USA
37	1.5	1.5	20	Space - Above and Beyond	1995	1	Fox

Table 3-2. Sampling frame for seasons.

Rank	Series Name	Total # of Seasons per Show	Seasons Included in Sampling Frame	Total # of Seasons Included per Show
1	Stargate SG-1	10	1.6.10	3
2	The X-Files	9	1.5.9	3
3	Star Trek - The Next Generation	7	1.4.7	3
4	Babylon 5	5	1.3.5	3
5	Star Trek - Deep Space Nine	7	1.4.7	3
6	Star Trek - Voyager	7	1.4.7	3
7	Battlestar Galactica (new)	4	1.3.4	3
8	Farscape	4	1.3.4	3
9	Stargate - Atlantis	4	1.3.4	3
10	Smallville	6	1.4.6	3
11	Quantum Leap	5	1.3.5	3
12	Star Trek - Enterprise	4	1.3.4	3
13	Lost	3	1.2.3	3
14	Sliders	5	1.3.5	3
15	Firefly	1	1	1
16	Dark Angel	2	1.2	2
17	Andromeda	5	1.3.5	3
18	Heroes	2	1.2	2
19	The 4400	4	1.3.4	3
20	Space - Above and Beyond	1	1	1
Total number of seasons in sampling frame =				54
Including two episodes per season, the total number of episodes in final sample =				108

Note: If there was an even number of seasons, the more recent of the two middle seasons was used. If there were three or fewer seasons, all seasons were included in the sampling frame.

Table 3-3. Season start and end dates for top five shows.

Rank	Series Name	Number of Weeks		Season Start Date	Season End Date
		Season	in the Season		
1	Stargate SG-1	1	22	July 27, 1997	March 6, 1998
		6	22	June 7, 2002	February 19, 2003
		10	20	July 14, 2006	March 13, 2007
2	X-Files	1	24	September 10, 1993	May 13, 1994
		5	20	November 2, 1997	May 17, 1998
		9	20	November 11, 2001	May 19, 2002
3	Star Trek - TNG	1	25	September 28, 1987	May 16, 1988
		4	26	September 24, 1990	June 17, 1991
		7	25	September 20, 1993	May 23, 1994
4	Babylon 5	1	22	January 26, 1994	October 26, 1994
		3	22	November 6, 1995	October 28, 1996
		5	22	January 21, 1998	November 25, 1998
5	Star Trek Deep Space Nine	1	20	January 3, 1993	June 20, 1993
		4	26	October 2, 1995	June 17, 1996
		7	25	September 30, 1998	June 2, 1999

Table 3-4. Number of weeks per included season.

Rank	Show Name	Season 1	Season 2	Season 3	Season 4	Season 5	Season 6	Season 7	Season 8	Season 9	Season 10
1	Stargate SG-1	21					22				20
2	X-Files	24				20				20	
3	Star Trek - TNG	25			26			25			
4	Babylon 5	22		22		22					
5	Star Trek Deep Space Nine	19			25			26			
6	Star Trek Voyager	15			26			26			
7	Battlestar Galactica	12	20	19							
8	Farscape	22		22	22						
9	Stargate Atlantis	19		20	20						
10	Smallville	21			22		22				
11	Quantum Leap	8		22		21					
12	Star Trek Enterprise	25		24	21						
13	Lost	24	23	22							
14	Sliders	9		25		18					
15	Firefly	14									
16	Dark Angel	21	21								
17	Andromeda	22		22		22					
18	Heroes	23	11								
19	The 4400	5		12	13						
20	Space - Above and Beyond	23									

CHAPTER 4 FINDINGS

Final Sample

The final sample consisted of 108 individual episodes taken from the top 20 science fiction television shows (see Table 4-1). The first year included in the sampling was 1987, and the last year was 2007, covering a total of 21 years. Only one episode had an air date in 1987. Three episodes aired during the first three months of 2008, but were kept in the final sample because they were part of a television season that began in 2007. Six episodes each from 16 of the top 20 shows were included in the final sample (two from the first season, two from the middle season and two from the last season). Four of the top 20 shows were on the air for less than three seasons and had fewer than six episodes in the final sample; *Dark Angel* and *Heroes* were on the air for two seasons between 1987-2007—each show contributed four episodes to the final sample; *Firefly* and *Space Above and Beyond* were on air for only one season between 1987-2007—each contributed two episodes to the final sample of 108 episodes.

Overall, a larger percentage of shows aired on cable versus network television; 66% (N=71) aired on cable¹ and 34% (N=37) aired on major networks² (see Table 4-2 and Figure 4-1). First-run syndications, shows with broadcast dates and times varying between different television stations, were coded as cable shows. The final sample (N=108) included 18 episodes from three first-run syndicated shows: *Andromeda*, *Star Trek Deep Space Nine* and *Star Trek: The Next Generation*.

A total of 193 scientist characters were coded in the final sample of episodes (N=108). There were at least one or more scientist characters in 94 episodes, and in 14 episodes, there were no scientist characters. Often, the same scientist character appeared in more than one or

¹ Cable stations represented in the sample were, Sci-Fi Channel, TNT, UPN, WB, USA, and first-run Syndications.

² Major networks represented in the sample were, NBC, ABC and FOX.

all episodes of a given show, and therefore is represented multiple times within the total number of coded scientist characters (N=193). For example, there were six episodes of *Stargate SG-1* included in the final sample of episodes (N=108). Dr. Daniel Jackson appeared in four of the six episodes, and Dr. Samantha Carter appeared in five of the six episodes.

Most categories were coded for primary and secondary representations. For example, all scientist characters (N=193) exhibited a primary personality trait, and 54% (N=101) also exhibited one or more secondary personality traits. When a scientist character appeared in multiple episodes, primary attributes were almost always consistent across the different episodes. Primary attributes that did occasionally vary from episode to episode were things such as personality traits and characterizations. Other attributes that varied across multiple episodes were physical appearance, age, love interest, and in one case, morality.

An example of varying personality traits was seen in Dr. Samantha Carter of *Stargate SG-1*, she exhibited the primary personality trait of conscientiousness in three of the five episodes she appeared in, and the primary trait of agreeableness in the other two episodes. Dr. Samantha Carter's secondary traits included openness, conscientiousness and agreeableness. Overall, her character was calm, cool and logical in approaching and solving scientific problems, but in one episode she also had the secondary trait of neuroticism. Dr. Carter was emotional about losing a team member and lost her temper with a fellow scientist. Throughout the episode, *Paradise Lost*, Dr. Carter exhibited an emotional instability and temperament that influenced her interactions with other characters.

Age varied for characters when they part of a long-running show, such as *Stargate SG-1*, which ran for 10 seasons. Dr. Samantha Carter appeared to be in her 30s in episodes from the

first and sixth seasons of *Stargate SG-*, and appeared to be in her 40s in episodes from the tenth season.

In only one case the morality of the scientist changed as the show progressed into later seasons. Scorpius, a futuristic scientist from the show, *Farscape*, was coded as morally “bad” in three episodes. He performed harmful experiments on human and alien subjects in order to obtain information about wormholes. Scorpius showed no regard for the pain he inflicted, and even seemed to enjoy the process. However, in a fourth episode, *What Was Lost Part I: Sacrifice*, he was morally neutral—his intended use for wormhole technology could potentially harm the people of Earth, but would preserve and protect another alien race. In all other cases, the morality of scientists appearing in multiple episodes did not change, and other attributes varied only slightly.

RQ 1

What is the dominant gender, personality, characterization and physical appearance of scientists in modern science fiction television shows?

Gender, Ethnicity and Aliens

The dominant gender and ethnicity of scientists in modern science fiction television shows is white and male; 63% (N=121) are male, and 37% (N=72) are female. Of those, 51% (N=99) are white males, and 27% (N=53) are white females (see Table 4-3). Because of the difficulty in judging ethnicity based on appearance, scientists were categorized as either white or non-white. In all cases it was possible to determine gender. In most cases it was clear whether a scientist was white or non-white, but it was not possible to safely judge the ethnicity of 6% (N=12) of the scientists; these scientists were categorized as unknown. All of the 12 scientists with an unknown ethnicity were alien scientists. For example, Zhaan of *Farscape* is a female scientist

whose skin is bright blue, and Rev Bem of *Andromeda* is an alien doctor with such an elaborate costume and make-up he more closely resembles a large insect rather than a human of any ethnicity. Because alien characters are common in the science fiction genre, whether or not a scientist was alien was examined in conjunction with gender and ethnicity.

Of the 193 scientist characters, 24% (N=46) were alien. Of those, 17% (N=8) were white male aliens and 30% (N=14) were white female aliens (see Table 4-4). There were no identifiable non-white male alien scientists, but 26% (N=12) of the female alien scientists were non-white. For example, Dr. Diana Davis on *Sliders* and chief engineer B'Elanna Torres on *Star Trek Voyager*. Interestingly, if scientists were alien, they were most often an attractive female; 70% (N=32) of all alien scientists (N=46) were female. Of the 32 female alien scientists, such as Zhaan of *Farscape*, T'pol of *Star Trek Enterprise*, and Trance of *Andromeda*, only five were not categorized as attractive.

Personality

Judgments about personality were based on a scientist's own actions and interactions with other characters. The personality of scientist characters was categorized using the "Big Five" model developed by psychologists. The Big Five model is widely accepted as one of the most reliable methods for empirical categorization and examination of personality (Goldberg, 1993).

The model includes five broad factors of personality:

- 1) Openness: the appreciation for art, adventure, imagination, curiosity and diverse experience.
- 2) Conscientiousness: self-discipline, dutiful actions, aim for achievement, planned rather than spontaneous behavior.
- 3) Extraversion: energy, positive emotions, and the tendency to seek stimulation and the company of others.

- 4) Agreeableness: a tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others.
- 5) Neuroticism: tendency to experience unpleasant emotions easily—anxiety, depression, or vulnerability, also considered emotional instability.

Conscientiousness was by far the dominant personality trait of scientist characters; 52% (N=100) of scientists had the primary personality trait of conscientiousness, followed by 28% (N=55) with the primary trait of agreeableness. Openness was the least common primary trait, with only 2% (N=3), but the most common secondary trait; 29% (N=56) of scientists had openness as a secondary trait. Following openness, the next most common secondary trait was agreeableness, with 21% (N=40) of scientists exhibiting this trait (see Table 4-5).

It is possible that the frequency with which conscientiousness is seen as a primary trait may be related to the context in which scientists are presented in the shows—most often they are working, they have a job to do and they dutifully follow protocol in order to carry out planned actions. A prime example of this trait can be seen in Dr. Weir of *Stargate Atlantis*, as the leader of the station she is often seen enforcing rules and carrying out plans to ensure the safety of her people. In the episode *First Strike: Part I*, Dr. Weir becomes upset with a military commander who insists on attacking an alien race that poses a potential threat to Earth. She opposes the abrupt attack and believes a solid plan along with attempts for negotiation would be the more appropriate action. Trip, the chief engineer on the show *Star Trek Enterprise*, serves as another example of conscientiousness. In the episode, *Breaking the Ice*, Trip accidentally reads a private correspondence meant for another crew member. Trip feels it is his duty to tell the crew member he read her private correspondence even though he knows she will be upset with him and embarrassed that someone else knows the contents of her message.

The second most common primary personality trait, agreeableness (28%, N=55), was frequently seen in medical scientists and doctors. Dr. Fraiser of *Stargate SG-1* insisted on helping injured individuals even when she was directed not to for reasons of safety or military protocol. Dr. Fraiser's personality was dominated by compassion for others, so her primary trait was agreeableness. Coming in a close second was her dedication to do her duty as a medical doctor and heal any individual who was in need, even if that individual was the enemy, making her secondary trait conscientiousness.

An example of openness can be seen in Kes, of *Star Trek Voyager*, who is training as a medical assistant in the episode, *Eye of the Needle*. Kes is a biologist who exhibits curiosity and an eagerness to learn, she even asks the doctor for additional reading and work so that she may accelerate her training and expand her knowledge beyond what is required to perform the medical assistant duties.

Extraversion and neuroticism were the least common traits overall. Only 11% (N=22) of scientists had extraversion as a primary trait, and 7% (N=14) as a secondary trait. Neuroticism was even less common, with 7% (N=13) of scientists having neuroticism as a primary trait, and 2% (N=4) as a secondary trait (see Table 4-5). Often, when scientists were categorized as having the primary trait of extraversion, they also had traits of conscientiousness and/or agreeableness, but they were not primarily driven by duty or compassion. Such was the case with Harper, a scientist in the show *Andromeda* and Chriton a scientist in *Farscape*. Both characters were dutiful to a degree and showed compassion toward other characters, but their personality was primarily colored by their social energy and interactions with others, during which they would frequently make jokes and tease people.

Most of the scientists categorized as primarily neurotic easily lost their temper or shifted emotional states, and/or seemed plagued by anxiety. Dr. McKay of *Stargate Atlantis* is one example of a neurotic scientist character plagued with constant anxiety. Dr. McKay worried about why he had to help catch the bad guys, whether or not he would get enough to eat and drink in order to sustain himself, if he had been exposed to some disease, and why he had to fill out performance reports for a staff he hardly knew, and didn't really want to know. In general, he was selfish, arrogant and most often concerned with self-preservation. On occasion, such as in the episode *Hide and Seek* where he sacrificed himself to save the lives of others, he also exhibited conscientiousness and agreeableness. Dr. McKay was not alone in exhibiting multiple personality traits, 52% (N=101) of all scientists (N=193) had one or two secondary personality traits. No scientists had four or more personality traits (see Table 4-5).

Characterizations

The list of characterizations was compiled from previous research by scholars in education, science fiction, film, and science communications³. Like personality, judgments about characterizations were based on scientists' actions and interaction with others, as well as their general demeanor. Scientists were examined for primary and secondary characterizations. All scientists (N=193) had a primary characterization, and 35% (N=68) had one or more secondary characterizations. There were seven possible characterizations: comedian, nerd, mad scientist, hero, charmer, genius, and regular guy/girl. Of the seven, only two were seen frequently enough to be considered significant as a primary characterization among scientists in modern science fiction television; 76% (N=147) had the primary characterization of regular guy/girl and 13% (N=25) had the primary characterization of genius. All other primary

³ See Czerneda, 1999; Frayling, 2005; Lambourne, Shallis & Shortland, 1990; Lambourne, 1999; National Science Board, 2002; Weingart, Muhl, & Pansegrau, 2003.

characterizations were seen in seven or fewer scientists. The most prominent secondary characterizations were genius (13%, N=25), hero (8%, N=16), comedian (8%, N=16), and regular guy/girl (8%, N=15) (see Table 4-6).

Scientists were categorized as regular guy/girl when they were not dramatically different from other characters in their mannerism and appearance, and when they did not clearly fit into another characterization. Most often, scientists with the primary characterization of regular guy/girl were either completely or nearly indistinguishable from other characters. As discussed in the previous chapter, it was necessary to do Internet research to determine who the scientists were and which characters to code as scientists. Further support for the finding that the regular guy/girl characterization is overwhelmingly dominant is modern science fiction television.

Regular guy/girl characterizations were seen both male and female scientists of all types: Mohinder Suresh a geneticist on *Heroes*, Dr. Simon Tam, a medial doctor on *Firefly*, Quinn, a physicist on *Sliders*, Dr. Daniel Jackson, an archeologist on *Stargate SG-1*, and Dr. Samantha Carter, an astrophysicist who appeared in episodes of both *Stargate SG-1* and *Stargate Atlantis*.

Seen in only 13% (N=25) of scientists, the primary genius characterization was a distant second to the primary characterization of regular guy/girl (76%, N=147) (see Table 4-6).

Scientists with the primary or secondary genius characterization were either self-identified as a genius, as was the case with Dr. McKay on *Stargate Atlantis*, or their superior intellect was pointed out by other characters, as was the case with Jool on *Farscape*. The only other characterizations seen with moderate frequency were comedian and hero, both were seen as a secondary characterization in 16 scientists. Sam, a time traveling physicist on *Quantum Leap*, whose primary characterization was regular guy/girl, was also characterized as a hero in every episode in which he appeared; each storyline involved Sam changing the timeline to save a life

or mend a relationship. Harper, the extroverted engineer on *Andromeda*, had the primary characterization of regular guy/girl, and the secondary characterization of comedian. Scientists with the comedian characterization were frequently making jokes, teasing other characters, and sometimes acted silly or goofy. For example, Harper showed a great fondness for making frequent jokes and amusing himself, sometimes at the expense of other characters.

The only scientist with the primary characterization of nerd was Dr. Phlox, who appeared in every episode of *Star Trek Enterprise*. Dr. Phlox also had the secondary characterization of comedian, but unlike Harper on *Andromeda*, Dr. Phlox was more the silly and goofy type of comedian—giggling as he cracked science jokes often understood only by him. Dr. Phlox, the ship's medical officer, is primarily portrayed as being very curious and passionate about all things related to medicine. One of the factors that led to his being categorized primarily as a nerd was the way that other characters responded to him. Dr. Phlox loved to ramble on about some obscure medical curiosity or scientific discovery and other characters in the scene would look at him as if he were talking to himself—completely entertained by his own fascination.

Brad Wilczek, a computer scientist in *Ghost in the Machine*, an episode of the *X-Files*, had the secondary characterization of nerd. Brad was socially awkward and portrayed as having an unusually close relationship with the massive computer he wrote a specialized program for, and appeared far more comfortable with his computers than he did with people.

The primary characterization of charmer was seen in only one scientist—Dr. Bronzino on the *X-Files*. Throughout the episode he attempted to gain the affections of fellow scientist character Dr. Dana Scully. Dr. Bronzino exaggerated the delivery of cheesy lines with wide-eyed grins. In a scene where they are talking about the possibilities of pheromones being the reason behind the strange attacks of an exotic fly, Dr. Bronzino says to Dr. Scully, “the bugs are

being somehow driven crazy with desire. You know, they say we humans respond to pheromones, too.”

Scientists with the mad scientist characterization (3%, N=6) had one thing in common—their motivations were considered bad or evil by other characters. For example, in *The Last Man: Part I*, an episode of *Stargate Atlantis*, an alien scientist named Michael kills one of the main characters, Tayla, so that he can use the genetic information in Tayla’s baby to take over the galaxy. Cyril, a biochemist in *Radar Love*, an episode of *Dark Angel*, is working to create a deadly bio-weapon. When another character named Max tries to stop the bio-weapon test, Cyril pulls out a gun, and while wildly screaming and waving it around, he tries to shoot Max. In this scene it becomes evident that Cyril is not only interested in money, but also in the survival and use of his creation, regardless of how many lives are lost.

Physical Appearance

Unlike personality and characterizations, physical appearance was based solely on the physical attributes of the character. Specifically coded for physical attributes included glasses, lab attire, pocket protectors, weapon, uniform, symbols of knowledge—books, computer, scientific equipment, whether a character was neat and groomed, messy, attractiveness, and age (see Table 4-7 and 4-8). Any other distinct physical attributes were also noted. The most common other attributes included facial hair, elaborate costumes, stylish attire or business suits.

Like the characterizations, the physical appearances of scientists were not distinct from other characters—they appeared as the regular guy/girl. Only 13% (N=26) of scientists wore glasses, 9% (N=17) wore a lab coat or other attire, such as a hazmat suit, 3% (N=5) were messy in their appearance and no scientists were seen with a pocket protector. Scientists who were categorized as messy had a generally un-kept appearance—their hair was greasy and uncombed,

and clothes were wrinkled and mismatched. For example, Brad Wilczek in *Ghost in the Machine* had a messy appearance. His hair appeared greasy and uncombed, his shirt un-tucked and wrinkled, and his clothes appeared to be too big for him making him look gangly and scrawny. Not all scientists were categorized as either messy or neat and well-groomed; scientists were only placed in one of these categories if their appearance clearly was messy or neat. No scientists had both a messy and neat appearance.

Overwhelmingly, scientists were neat/well-groomed (87%, N=167), and attractive (71%, 137) (see Table 4-7). Scientists who were neat/well-groomed had clean and combed hair, women most often wore make-up, if men had facial hair it was neatly trimmed, their clothes and outfits were often stylish in addition to being clean and well-fitted, and if they were in uniform, their uniforms were clean and pressed. A few scientists who were categorized as neat/well-groomed included Dr. Daniel Jackson and Dr. Samantha Carter from *Stargate SG-1*, Dr. McKay and Dr. Weir from *Stargate Atlantis*, and Geordi LaForge the chief engineer on *Star Trek: The Next Generation*. All of these scientist characters also wore a uniform. With 49% (N=95) of scientists in uniform, this was the next most common physical attribute behind neatness (87%, N=167) and attractiveness (71%, 137).

The uniforms were sometimes military, but most often they were futuristic style crew uniforms worn by every body working on a space station, spaceship, or other fictional/futuristic facility. For example, Scientists in *Stargate SG-1* and *Stargate Atlantis* wore typical army-style uniforms in episodes when they ventured off-world to explore some new planet or phenomena. A few of the scientists who wore ship or station crew uniforms were Harper in *Andromeda*, Trip and T'pol in *Star Trek Enterprise*, Dr. Crusher and Geordi LaForge *Star Trek: The Next Generation*, and Dr. Stephen Franklin in *Babylon 5*.

Judging the attractiveness of a character was based on several factors: healthy appearance, height/weight proportion, and the best personal judgment of the coder. Initially it was believed that attractiveness would be difficult to judge, and any judgments would be far too subjective to be reliable. However, the intercoder reliability for this category was surprisingly high (Holsti .90), and the sheer number of scientists who were found to be attractive (N=137) suggests the data is reliable. Attractive scientists included Dana Scully on the *X-Files*, T'pol (a female ethnic alien) and Trip on *Star Trek Enterprise*, Dr. Jack Shepard and Dr. Juliet Burke on *Lost*, and Dr. Simon Tam on *Firefly*.

In the absence of any direct references by the scientists or other characters, the average age of scientists (see Table 4-8) was based on the best personal judgment of the coders. It was found that 53% (N=103) of scientists appeared to be in their 30s, and 31% (N=59) appeared in their 40s. Only 9% (N=18) appeared to be in their 20s, and even fewer still appeared to be over 50 (4%, N=8).

Aside from being young, neat and well-groomed, attractive, and often in uniform, 35% (N=68) of scientists were seen with symbols of knowledge, and 14% (N=27) carried or used a weapon (see Table 4-7). Symbols of knowledge included using computers, lab equipment such as microscopes or beakers, medical equipment, carrying, using or reading books, and any fictional or futuristic equipment. Traditional medical and laboratory equipment was used by Dr. Juliet Burke in *D.O.C*, an episode of *Lost* where she performs an ultrasound of a pregnancy, and by scientists in shows like *The 4400*, which is set in present day as opposed to the future. However, most often the symbols of knowledge took the form of futuristic computers and equipment, such as the brain scanning device used by Dr. Crusher and Geordi LaForge in *Inheritance*, an episode of *Star Trek: The Next Generation*, or the nanite technology that allowed

an alien race of replicators to take control of Dr. Weir in an episode of *Stargate Atlantis*. Dr. McKay was attempting to free Dr. Weir by rewriting the nanite code. In the same episode of *Stargate Atlantis, Lifeline*, Dr. McKay and Dr. Samantha Carter are both in uniform and carrying weapons. Other weapons-toting scientists included John Chriton on *Farscape*, who either carried or used a weapon in all six episodes in which he appeared, Dr. Daniel Jackson on *Stargate SG-1*, who had a weapon in all four of the episodes in which he appeared, and Dr. Crusher on *Star Trek: The Next Generation*, who used her futuristic phaser weapon in a battle during the episode *Arsenal of Freedom*.

To answer the first research question concisely, the scientists in modern science fiction television shows are most often males (63%, N=121) with a conscientious (52%, N=100) and agreeable (28%, N=55) personality. They are rarely distinguishable from other characters, and they are generally young—in their 30s or 40s, neat, well-groomed and attractive.

RQ 2

Which scientific disciplines are most frequently portrayed in modern science fiction television shows?

Determining which scientific disciplines were most commonly seen involved tracking the types of scientists who appeared in the episodes, and the types of science included in the episodes. It was found that the presence of one—scientists, did not necessarily coincide with the presence of the other—science. If an episode included a scientist character who was a doctor, it did not necessarily mean that medical sciences were at any time portrayed in the episode. For example, in *The 23rd Psalm*, an episode of *Lost*, Dr. Jack Shepard, a medical doctor, is the only scientist character in the episode, but there was at no time any medical sciences portrayed in this episode. The only type of science portrayed in this episode was

paranormal science. Conversely, the presence of a particular science was not always associated with a scientist of the same specialization. For example, in *Breaking the Ice*, an episode of *Star Trek Enterprise*, the primary science portrayed in the episode was geology. The crew landed on an asteroid to extract a sample of a rare mineral so that it could be studied by scientists, however, none of the scientists portrayed in the episode appeared to be geologists. The scientists in *Breaking the Ice* were Trip, the chief engineer, T'pol the science officer, and Dr. Phlox, the doctor.

Scientists

Each scientist character was categorized as one primary type of scientist. The primary type of scientist was the science a character appeared to specialize in or was most often seeing practicing or discussing. Most often it was difficult, if not impossible, to guess what type of scientist a character portrayed based solely on the content of a single episode. For this reason the final determination of the primary type of scientist portrayed by a character was often based on the same Internet research that was used to identify who the scientist characters were in each show and episode.

A total of nine different types of scientists (see Table 4-9) were seen in the 108 science fiction episodes. Doctors, with 32% (N=61), made up the largest group. Traditional medical doctors practicing present day medicine included Dr. Juliet Burke on *Lost* and Dana Scully on the *X-Files*. Dr. Burke performed an ultrasound to check the progress of a pregnancy, and Dr. Scully performed a post-mortem examination to determine cause of a mysterious death. Other doctors, most often portrayed in shows that took place in the future or on another planet, practiced fictional or futuristic medicine. For example, Dr. Crusher on *Star Trek: The Next Generation* used a handheld scanning device to detect illness or injury. Similarly, Dr. Carson

Beckett on *Stargate Atlantis* used a full body scanner to detect injury, illness or the presence of nanites in his patients, and Dr. Stephen Franklin on *Babylon 5* was a specialist in xenobiology—alien biology.

The next most frequently seen scientists were astronomers and physicists (20%, N=38), followed by engineers (13%, N=25) (see Table 4-9). Scientists in these categories were often seen practicing theoretical physics and futuristic engineering. For example, Dr. Samantha Carter on *Stargate SG-1* is an astrophysicist who specializes in wormhole technology and theory. Dr. Rodney McKay is a fellow astrophysicist with the same specialization who appears on the sister series to *Stargate SG-1*, *Stargate Atlantis*. Engineers Geordi La Forge (*Star Trek: The Next Generation*) and B'Elanna Torres (*Star Trek Voyager*) work aboard star ships and are often called upon to provide technical solutions to life-threatening problems. For example, in the episode *Parallax*, Torres suggests that remodulating the tractor beam to match sub-space interference might allow them to break through the event horizon of the singularity and save the stranded ship.

The fourth most frequently seen type of scientist was fictional/futuristic (12%, N=24). Scientists were not categorized as a fictional/futuristic scientist unless they practiced some form of science that in no way resembled or was related to any known scientific discipline. For example, Sikoze, a female alien on *Farscape*, is an expert on Leviathans—living spaceships. She was categorized as a fictional/futuristic scientist. Sometimes a scientist practiced fictional or futuristic science within their discipline, but the science they practiced was very similar to a known science. For example, Zhaan, a female alien on *Farscape*, is a botanist who works with alien plants and performs futuristic experiments to find medicines for healing her crew and her

sentient ship. Although there are fictional/futuristic elements to the science she practices, Zhaan is primarily a botanist, so her primary type of science was coded as biology.

The last five categories of scientists (social/other, biologists, archeologists, computer scientists, geologists) were not as strongly represented as the first four (medical, astronomer/physicist, engineer, fictional/futuristic). The largest of these last five categories was social scientists/other (7%, N=13) (see Table 4-9). The category included social scientists such as political scientists, historians and psychologists. For example, Dr. Weir on *Stargate Atlantis* is a political scientist whose specialization in international negotiations landed her the job of running the Atlantis base on an alien planet, and Ezri on *Star Trek Deep Space Nine* is a psychologist responsible for monitoring the mental health of the station's crew. The social scientist/other category also included scientists whose field of expertise could not be identified either from the episodes or by Internet research, and who did not fit into the fictional or futuristic category, such as Marco on *The 4400*. Marco works for a secret government organization solving theoretical and social problems related to the 4400 people who were returned to the present, from the future, in order to reshape history and protect Earth from a devastating future. He works in a room full of high-tech equipment, computers, plasma screens and maps, and explains the 'ripple effect' that takes place when a 4400 person changes the course of history. The fact that he was a scientist could be confirmed through Internet research, but the same research did not reveal what type of scientist he was. The same was true for Rev Bem, an alien scientist on *Andromeda*, and two unnamed scientist characters in two separate episodes of *Smallville*.

Biologists (6%, N=12), archeologists (5%, N=9) and computer scientists (5%, N=9) were all nearly equal in their overall representation (see Table 4-9). Scientists falling into the biology

category (6%, N=12) were some of the easiest to identify. Biologists were frequently portrayed in a laboratory setting performing experiments and looking through microscopes as they explained their work to another scientist or non-scientist. For example, in an episode of *Stargate Atlantis*, Dr. Carson Beckett visits a newly discovered world where Perna, a local government biologist, explains how she is developing a special vaccine to protect her people from being fed upon by the Wraith. As they talk Perna asks Dr. Beckett to view her work through a nearby microscope. The show with the most scientist depictions in the archeologist category (5%, N=9) was *Stargate SG-1*. One of the main characters, Dr. Daniel Jackson, is an archeologist who specializes in Egyptology. Computer scientists (5%, N=9) were seen in only three shows, *The X-Files*, *Stargate Atlantis*, and *Battlestar Galactica*; Brad (The X-Files) created a learning computer that eventually learned how to kill, Dr. Baltar (*Battlestar Galactica*) is a computer scientist who inadvertently gave the Cylons, and enemy race of cybernetic beings, access to his government's computerized security systems, which resulted in the destruction of his world. The category with the fewest number of scientists was geologists (1%, N=2). *Smallville* was the only show that portrayed a geologist. Dr. Steven Hamilton, who appeared in two episodes—*Craving* and *Obscura*, was a geologist studying Kryptonite, an alien mineral discovered in pieces of a meteorite that crashed in the town of Smallville.

In looking specifically at the different genders, medical doctor was the most frequently portrayed type of scientist for both female and male characters; 36% (N=26) of all female scientists and 29% (N=35) of all male scientists were doctors (see Table 4-9). The second most common type of scientists for females was fictional/futuristic (19%, N=14), and for males, astronomers and physicists (20%, N=24) (see Table 4-9).

An interesting finding was the connection between being an alien, and being a fictional/futuristic scientist, 14 out of the 15 cases in which a female was a fictional/futuristic scientist, she was also an alien. Examples include Sikozy, the Leviathan expert on *Farscape*, and Jadzia Dax, the station science officer on *Star Trek Deep Space Nine*. The same was true for males, nine out of the 10 male fictional/futuristic scientists were alien. Examples include Scorpius on *Farscape*, an evil scientist who used futuristic technology and equipment to gain information about wormholes, and Michael, a Wraith scientist on *Stargate Atlantis* who created a race of bioengineered monsters to rule the galaxy.

Science

The individual sciences portrayed in each episode were categorized in much the same way as the types of scientists. As mentioned, a science could be portrayed without an associated scientist. Sciences were categorized as primary and secondary. The most prominent science was coded as the primary science, and all other portrayed sciences were coded as secondary sciences. All episodes (N=108) had a primary science, and 85% (N=92) had one or more secondary sciences (see Table 4-11).

It was found that there is no relationship between the most frequently portrayed types of scientists and the most frequently portrayed types of science. Whereas doctors were the most frequently portrayed type of scientist, the most frequently portrayed primary science was paranormal (21%, N=23) (see Table 4-11). Paranormal sciences such as telepathy, ESP, UFOs, unexplained natural phenomena were the primary science in most episodes of *Lost*, *Heroes*, *The 4400* and *Smallville*. *Heroes*, *The 4400* and *Smallville* all have storylines that revolved around people with special abilities and/or superhuman powers. In *The 4400*, people had been taken to the future, neurologically altered to have special abilities, and sent back in time to change the

past and correct mistakes that would otherwise lead to a devastating and destructive end for all humanity. *Smallville* is based on the story of Superman and takes place in a small town where countless residents have been physiologically altered to have unusual abilities or diseases. Alterations were caused by coming into contact with a strange mineral from another planet. *Lost* dealt primarily with unexplained and natural phenomena; in one episode two characters discuss what might be causing the strange magnetic force that is coming from behind a thick concrete wall, and in another episode a monster made of black smoke chases people through the jungle.

No one type of science was overwhelmingly dominant as the primarily portrayed science. Following paranormal science (21%, N=23), was computers/technology (18%, N=19), which was the primary science in three episodes of *Andromeda*, a show that revolves around a spaceship named Andromeda, which is a sentient being and has several avatars that represent it in human form. All of the Andromeda's holographic and robotic avatars are exceptionally attractive females who frequently explain the technological capabilities of the ship.

Astronomy/physics (17%, N=18) and medical sciences (10%, N=11), were the next most frequently portrayed primary sciences in an episode (see Table 4-11). Astronomy/physics (17%, N=18) was often prominent in episodes with stories that revolved around wormholes or temporal distortions. For example, in *The Visitor*, an episode of *Star Trek Deep Space Nine*, a temporal distortion traps a crew member in subspace. As a second example, in every episode of *Stargate SG-1* the SG-1 team travels to other planets by stepping through a large circular gate-like device that creates a wormhole between two locations. Characters often discuss how the Stargate works or why it didn't work, and repair malfunctions or missing parts, as was the case in the episode *Bad Guys*.

Unlike some of the other sciences, medical science (10%, N=11) was often seen actually taking place rather than being discussed or simply being peripheral to a story. For example, an ultrasound (*Lost – D.O.C.* and *Star Trek Voyager – Lineage*), genetic alterations done with a computer (*Star Trek Voyager – Lineage*), healing a battle wound with herbs (*Star Trek: The Next Generation – Arsenal of Freedom*), repairing a collapsed lung, delivering a baby, and setting a broken leg (*Lost – Do No Harm*).

Like the scientists who were biologists, the science of biology (8%, N=9), including botany and genetics, was frequently seen in laboratory settings and easily identified by the goals of the scientists, which they themselves often explained. For example in *Poisoning the Well*, an episode of *Stargate Atlantis*, scientists develop a vaccine designed to protect them from an alien race. All the biology in this episode takes place in a laboratory and medical facility where the two scientists are surrounded by test tubes, beakers and microscopes. When one of the scientists looks through a microscope, the image of active cells squirming around on a glass slide is shown to the audience so that the viewers may see what the scientist is seeing. In *Lineage*, an episode of *Star Trek Voyager*, B’Elanna Torres, the chief engineer, sneaks into the medical facility and uses a futuristic computer program to genetically alter her unborn child. Torres wants to eliminate what she perceives to be the undesirable physical features of a Klingon, even though she herself is half Klingon and half human. A full color holographic image of her unborn child’s DNA is project by the computer, and sections of the DNA disappear as Torres deletes certain genetic traits.

Following biology (8%, N=9), was engineering (6%, N=7) and fictional/futuristic sciences (6%, N=6) (see Table 4-11). Engineering was often the primary science seen in episodes where a spaceship or space station needed some repair or re-engineering. For example, in *PK Tech*

Girl, an episode of *Farscape*, the characters work to repair a defense shield generator in order to survive an impending attack by the Sheyang—fire-breathing aliens. Fictional or futuristic sciences were similar to the fictional/futuristic scientists in that they were unrelated and dissimilar from any commonly recognized science. For example, in *The Last Man: Part I*, an episode of *Stargate Atlantis*, John Shepard is accidentally transported thousands of years into the future where a holographic recoding of a scientist, Dr. Rodney McKay, tells him that a solar flare was responsible for sending him to the future and that he will not be able to attempt return until another solar flare occurs in a couple hundred years. The story revolves around futuristic/fictional technology and science is used to justify the events and solve the problems of returning Shepard to his own time. For example, the holographic representation of a long-dead Dr. McKay, and the stasis chamber that will preserve Shepard in hibernation until the next solar flare occurs in a couple hundred years.

Social sciences/other (5%, N=5), geology (5%, N=5), and archeology/anthropology (4%, N=4) were the least commonly portrayed primary sciences (see Table 4-11). The social sciences/other (5%, N=5) category was dominated by political science, which was the primary science in three episodes of *Babylon*. All three episodes revolved around political and military confrontations between alien races and the attempts by their leaders to reach peaceful resolution. Of the episodes that portrayed geology (5%, N=5) as the primary science, two episodes portrayed ‘a lot’ of geology taking place throughout the episode: *Inheritance* (*Star Trek: The Next Generation*) and *Breaking the Ice* (*Star Trek Voyager*). In *Inheritance* the crew of the Enterprise is on a mission to save a planet with a solidifying molten core. To prevent the core from solidifying they drill into the planetary crust and place “plasma fusion injectors” above the core. In *Breaking the Ice*, the crew plans and carries out a mission to retrieve a rare mineral

from a comet. Archeology/anthropology (4%, N=4) was the least frequently seen primary science. Anthropology was the primary science in an episode of *Stargate SG-1* where the team makes first contact with a new alien race, the Nox, and attempts to understand their culture and way of life in order to form an alliance and protect them. In an episode of *Star Trek Deep Space Nine*, an archeologist named Vash brings a collection of alien artifacts to the space station with the goal of having a rare artifact auction for wealthy collectors, but one of her artifacts turns out to be the cause of a serious power drain that cripples the space station.

How Much Science

The extent to which a science was "portrayed" in an episode varied greatly. In some cases one or more sciences were prominent throughout the episode and physically practiced by one or more characters, in other cases science was merely spoken about in a conversation or practiced by one character in a single scene.

The judgments about the quantity of included science were based on how often science was seen, practiced or talked about. Of the 108 episodes examined in this study, 48% (N=52) portrayed a lot of science; 23% (N=25) portrayed some science; and 28% (N=30) portrayed very little or no science (see Table 4-10).

'A lot' of science meant that science was prominent throughout an episode, as was the case in *Pegasus*, an episode of *Star Trek: The Next Generation* that depicts both the chief engineer, the chief scientist and several other characters trying to solve the mystery of how a ship rematerialized partially inside an asteroid, and how they were going to get it out. In this case, science was used to solve problems, it was practiced and discussed in multiple scenes throughout the episodes, and was central to the story.

‘Some’ science meant that science was practiced or talked about a few times, but was more peripheral to the story. For example, in *Darkness Falls*, an episode of the *X-Files*, entomology is portrayed, but only briefly as the scientists analyze an ancient and unknown insect found inside an old-growth tree. Dr. Dana Scully and a park ranger briefly discuss the insect and the strange hibernation that has preserved it for hundreds of years. Science does remain peripheral to the story, lending credibility to the events, but the majority of the episode depicts the characters stranded in a forest trying to avoid getting their flesh sucked out by swarms of this strange insect.

‘Very little’ meant that there was no or almost no obvious science in the episode. For example, most episodes of *Quantum Leap* involved very little actual science. The scientist, Sam, traveled through time. In each episode his consciousness would briefly take over the consciousness of some person who he would have to help in one way or another, generally saving their life by preventing a fight or a car crash, or making sure they found their medication. Science was peripheral in that it gave credibility to the story of traveling through time. The opening sequence of the show explained how Sam was a physicist who invented this technology of time travel and was now stuck in a never-ending loop unable to return to his own time. Beyond lending credibility to time travel and the computer hologram he communicated with, there was no science in any of the *Quantum Leap* episodes.

As mentioned, all episodes (N=108) had one primary science, and 85% (N=92) had one or more secondary sciences (see Table 4-11). Overall, including both primary and secondary portrayals, fictional/futuristic science was portrayed more than any other science, with 65% (N=70) of all episodes (N=108) including some amount of fictional/futuristic science. Of these, 58% (N=63) were secondary portrayals, meaning that these portrayals were most often

fictional/futuristic versions of a traditional and known science, such as biology, physics or medical sciences.

Because the extent of portrayals—the amount of science—in each episode varied so greatly, to answer research question number two, which scientific disciplines are most frequently portrayed in modern science fiction television shows, three ranked lists were compared: (1) the top five most frequently portrayed types of scientists (see Table 4-9), (2) the top five most frequently portrayed primary sciences (see Table 4-11), and (3) the top five most frequently portrayed sciences overall, including both primary and secondary portrayals (see Table 4-11). Only two scientific disciplines consistently ranked in the top five on all three lists—astronomy/physics and medical sciences.

RQ 3

What are the dominant themes in modern science fiction television shows?

A list of six overarching science fiction themes published in *The Visual Encyclopedia of Science Fiction* (1978) served as the guide for determining the dominant themes in modern science fiction television shows⁴. The six possible themes were (1) space exploration and the military complex, (2) people and superhumans, (3) extra dimensions, (4) aliens and monsters, (5) future of alternate human societies, and (6) robots, computers and gadgets. A seventh category of ‘other’ served as a catch-all for any science fiction episode with a theme that did not clearly fit into any of the six themes or sub-themes defined by *The Visual Encyclopedia of Science Fiction* (1978).

Like many of the other categories examined in this study, for each episode both primary and secondary themes were noted. The dominant theme throughout an episode was categorized

⁴ See Appendix A, Definitions, Science fiction themes and sub-themes

as the primary theme. Any other themes present in an episode were categorized as secondary themes. The results reveal the most frequently seen dominant, or overarching themes in modern science fiction television, as well as the most commonly seen themes overall (primary and secondary combined), regardless of their prominence (see Table 4-12).

Space Exploration the Military Complex

Space exploration and the military complex was found to be the dominant primary theme in the science fiction episodes; 56% (N=60) of all episodes (N=108) had the primary theme of space exploration and the military complex (see Table 4-12). This theme was seen in episodes of all the *Star Trek* shows (*The Next Generation*, *Deep Space Nine*, *Voyager*, *Enterprise*), *Stargate SG-1*, *Stargate Atlantis*, *Farscape*, *Firefly*, *Andromeda*, *Battlestar Galactica* and *Babylon 5*. The most significant commonality between all these shows is the inclusion of a space ship, space station or military base, and its crew of explorers. In the *Star Trek Voyager* episode *Parallax* the ship and crew become trapped in a black hole, and in both *Stargate SG-1* and *Stargate Atlantis* the crew works for a secret military organization and travels around the galaxy through wormholes while they search for advanced technology to help defend Earth and other planets from hostile aliens. Politics and the military are prominent in *Battlestar Galactica* and *Babylon 5*. Both shows take place in space and revolve heavily around political and military confrontations. For example, in one episode of *Battlestar Galactica*, a battleship previously thought to have been destroyed rejoins the fleet. At first the crews and commanders of both battleships, *Galactica* and *Pegasus*, are happy to be reunited, but eventually a power struggle erupts when the commander of *Pegasus* pulls rank and decides to reassign military personnel and reorganize the political structure of the fleet.

People and Superhumans

With 56% (N=60), space exploration and the military complex was overwhelming dominant as the primary theme. People and superhumans was a distant second with 20% (N=22), followed by extra dimensions, seen as the primary theme in 9% (N=10) of all episodes (N=108), and aliens and monsters seen in 7% (N=8) of episodes (N=108) (see Table 4-12). People and superhumans was the primary theme in all episodes of *Heroes*, *The 4400*, *Smallville*, *Dark Angel*, and several episodes of *The X-Files*. *Heroes* and *The 4400* are both about people with seemingly supernatural abilities, for example Hiro on *Heroes* can bend and stop time allowing him to travel through time to the past and future, and Shawn on *The 4400* has the ability to heal people just by placing his hands on them. The series *Smallville* is the story of superman growing up in a rural town plagued by strange occurrences that all seem to be related to a crashed meteor. In one episode, *Craving*, a young girl desperate to lose weight begins drinking homemade shakes made with vegetables grown in soil that has been tainted by crystals from the crashed meteor. She very quickly loses weight, but also has a new and insatiable appetite that drives her to start eating people. Clark (superman) eventually saves the day and stops the starving teen girl. In *Dark Angel*, Max is a bioengineered super-soldier created by the military. She escaped from her creators when she was a small child and has been in hiding ever since.

Extra Dimensions

The extra dimensions theme, primary in 9% (N=10) of the episodes (N=108), was often seen in episodes or shows about traveling through time or traveling to other dimensions (see Table 4-12). *Quantum Leap* is a science fiction television show about a physicist named Sam, whose consciousness is trapped in time travel—he “leaps” from one point in time to another

never knowing where he will wind up or whose body his consciousness will temporarily take over. In *Sliders* a group of people are stuck in a similar predicament, except they are stuck traveling from one dimension to another, never knowing where they will “slide” to or if they will ever get home. In *Quantum Leap* the episodes feature places and stories that are not far removed from reality. For example, in one episode Sam is an African American chaffer dealing with segregation in the post Civil War south, and in another he is a bounty hunter struggling to control a pretty young woman wrongly accused of a crime. In *Sliders* on the other hand, the group often winds up in an alternate dimension where things are far removed from known reality. For example, in *Heavy Metal* they slide to a reality where the aviation industry never developed, it is a version of Earth where the maritime industry rules, along with power-hungry pirates who are determined to prevent airborne transportation from making maritime shipping obsolete.

Aliens and Monsters

The aliens and monsters theme, the primary theme in 7% (N=8) of episodes, was evident when aliens or monsters served as the foundation for the entire episode (see Table 4-12). For example, in the *Sliders* episode *Sole Survivors*, the group of inter-dimensional travelers slide to a reality where the majority of the population has been infected with a virus that turned them into flesh-eating zombies. The travelers spend the entire episode searching for a cure while battling zombies around every corner.

Often, primary themes were the same in episodes from the same show—people and superhumans was the primary theme in all six episodes of *Smallville*, but this was not always the case. For example, in three episodes of *Stargate Atlantis* the primary theme was space exploration and the military complex, but in the other three episodes the primary theme was

aliens and monsters. In all three episodes where aliens and monsters was the primary theme, the story revolved around battling an evil alien or group of aliens. In *Poisoning the Well* scientists work to find a vaccine that will prevent the Wraith (an evil race of aliens) from being able to feed on innocent people. In *Submersion* a team of explorers and scientists are trapped in an underwater facility with a powerful Wraith who is manipulating one team member and killing others, and in *First Strike: Part I*, the Atlantis team works with a military team from Earth to plan and carry out an attack on the replicator home-world in order to destroy the fleet of warships the replicators are building for an attack on Earth—their primary goal throughout the episode is to stop the replicators from replicating.

Future or Alternate Human Societies

The least common primary science fiction themes were future or alternate human societies (1%, N=1), and robots, computers and gadgets (1%, N=1) (see Table 4-12). Although both themes are seen as primary in only one episode each, they are more common as secondary themes. Because each of these themes appears only once as a primary theme some examples will come from secondary appearances. While not common as a primary theme, future or alternate human societies is the most common secondary theme (54%, N=58). The future or alternate human societies theme was the primary theme in *The Seer*, an episode of *Sliders* that takes place in an alternate reality where the entire population of people worships one individual they call the seer. The people believe the seer is a prophet. The inter-dimensional travelers who become trapped in this alternate reality slowly learn more about the people, their beliefs, and the political powers that are using the seer to brainwash the population and orchestrate the creation of their ideal society. The future or alternate human societies theme was a secondary theme in all six episodes of *Battlestar Galactica*. While the primary theme of all six episodes was space

exploration the military complex, the second most prominent theme in all episodes was that the storylines were all heavily focused on the people, their relationships, and social structure of life on the battleship. For example, in the episode *Pegasus* the commanders and crews from two different battleships clash because of different social structures and priorities. The commander and crew of the *Galactica* seem to place human loyalty and emotion above military protocol. For example, the commander and crew look the other way and ignore the fraternization between an officer and a subordinate who have fallen in love. The commander of *Pegasus*, who enforces strict military protocol in all situations, demands that the affair come to an end, and even reprimands the *Galactica* commander for allowing the relationship to continue.

Robots, Computers and Gadgets

Robots, computers and gadgets, a primary theme in only one episode, was a secondary theme in 12% (N=13) of all episodes (N=108) (see Table 4-12). Robots, computers and gadgets was identified as a theme whenever technology played a significant role in an episode. For example, in *Ghost in the Machine*, an episode of *The X-Files*, a learning computer known as the C.O.S. (Central Operating System) project controls all the computerized systems for high-tech company. No one realizes just how much the C.O.S. has learned and developed. When the C.O.S. finds out that it is scheduled to be shutdown due to poor performance, the computer begins eliminating anyone who threatens its continued operation. In one scene, the computer crashes an elevator killing an FBI agent, and in another scene the computer electrocutes the man responsible for initially terminating the C.O.S. project. *Ghost in the Machine* was the only episode in which robots, computers and gadgets was the primary theme. The theme robots, computers and gadgets also included any significant portrayals of artificial intelligence in humanoid form, or cybernetic beings, such as Data on *Star Trek: The Next Generation*. Two

episodes of *Star Trek: The Next Generation*, both portraying Data in a major role, had the secondary theme of robots, computers and gadgets. In *Inheritance*, a woman claiming to be Data's mother—one of his creators—shows up on the Enterprise. Data later discovers that she is also a cybernetic humanoid, but she is unaware of that fact. In *Arsenal of Freedom* the crew of the Enterprise winds up on a planet where the only business is manufacturing weapons to supply wars. The crew's arrival triggers an automatic demonstration of the locally produced weapons available for purchase, including robotic soldiers who attack crew and drive them into hiding.

Lost, the 'Other'

The catch-all 'other' category was meant to accommodate any themes which did not fit into the six themes detailed in *The Visual Encyclopedia of Science Fiction* (1978). The only science fiction television show with primary themes in the 'other' category was *Lost* (see Table 4-12). All six episodes of *Lost* had a primary theme in the 'other' category. The episodes revolved around survivors of a plane crash trapped together on an island plagued by mysterious phenomena. Although the show is about people, their relationships, and seemingly paranormal occurrences, no episode takes place in the future or any alternate dimension or reality, technology plays no significant role, and no character demonstrates any special or supernatural power. One episode did have the secondary theme, aliens and monsters. During one scene in *The 23rd Psalm*, a monster made out of black smoke emerges from the jungle and engages in a momentary stare-down with a character named Mr. Eko, the monster then retreats back into the jungle leaving several characters shaken by the mysterious experience.

Other than *Lost*, every science fiction episode had a primary theme that was easily identified and fit clearly into one of the six categories laid out in *The Visual Encyclopedia of*

Science Fiction (1978). All episodes (N=108) had one primary theme, and 71% (N=77) also had one or more secondary themes.

In order to answer the third research question about the most dominant themes in modern science fiction television, the frequency of both primary and secondary themes was considered together. Based on both primary and secondary inclusions, the most dominant themes in modern science fiction television shows are space exploration the military complex, seen in 59% (N=64) of the sample (N=108), followed closely by future or alternate human societies, which was a theme in 55% (N=59), and aliens and monsters, a theme in 43% (N=46) of all episodes included in the sample (N=108) (see Table 4-12).

RQ 4

Are scientists and science most often portrayed as beneficial? Or harmful and dangerous?

Coding recorded the occurrences of beneficial and/or harmful and dangerous portrayals of scientists and science. The science and scientists in each episode were categorized based on whether or not they exhibited a particular portrayal—beneficial, or harmful and dangerous. Scientists and science did not have to exhibit one or the other (beneficial, or harmful and dangerous), sometimes they exhibited neither, and sometimes they exhibited both. When it was unclear or unknown whether science or scientists were portrayed as beneficial or harmful, then the science or scientists were categorized as not exhibiting that portrayal. Sometimes, harmful or beneficial science was not portrayed on screen in conjunction with a scientist. For a scientist to be portrayed as beneficial or harmful they had to actually be in the episode, not simply referred to by other characters.

Most often, when scientists were portrayed as beneficial, so was science. Of the 108 episodes analyzed, 56% (N=60) portrayed scientists as beneficial and 61% (N=66) portrayed

science as beneficial (see Table 4-13). Unlike the beneficial portrayals, there was more divergence between the harmful portrayals of scientists and the harmful portrayals of science. Scientists were portrayed as harmful and dangerous in only 25% (N=27), and science was portrayed as harmful and dangerous in almost twice as many episodes, 47% (N=54) (see Table 4-13).

Scientists and Science: Beneficial

The portrayals of scientists and science were considered beneficial if they preserved and protected life, furthered positive scientific or social development and progress, or solved problems such as disease, illness or crime. For example, in *Ageless*, an episode of *Smallville*, biology is used to explain the accelerated aging of a young boy as scientists work to stop the aging process and save the boy's life. In *Hide and Seek*, an episode of *Stargate Atlantis*, scientists design a special generator to lure a power-draining entity away from the Atlantis base. The generator works, and they save the base from destruction. In an episode of *Star Trek Deep Space Nine*, *It's Only a Paper Moon*, psychology and technology are used together to benefit one individual—an alien character named Nog, who is having trouble recovering from the psychological trauma of losing his leg. The ship's counselor prescribes a course of treatment that will allow Nog to live in a holodeck—a simulated reality—for a period of time while he slowly readjusts to life. His physical and psychological progress is monitored while the computer generated people in the holodeck program slowly help Nog regain his mobility and self confidence.

Scientists and Science: Harmful and Dangerous

Portrayals were considered harmful and dangerous when scientists or science presented a threat to people, places or things. Such as when there was an emphasis on the potential harm of

the science being done, or emphasis on harmful and dangerous situations that were a result of science or the actions of scientists. For example, in *Arsenal of Freedom*, an episode of *Star Trek: The Next Generation*, several crew members become stranded on a planet where all the inhabitants have been destroyed by their own weapons science and technology. A demonstration program, designed to demonstrate the worthiness of the high-tech weaponry to potential customers, malfunctioned and caused the weaponry to hunt its creators as part of the demonstrative simulation. The demonstration program, which was running in an endless loop, also caused the robots and stealth canons to hunt down and kill anything or anyone that came to the planet. The crew eventually managed to permanently shut down the simulation. Science was portrayed as harmful and dangerous in *Arsenal of Freedom*, but the scientists were not. The scientists who created the weaponry were not portrayed in the episode; they had been killed by their creation hundreds of years earlier.

When scientists and science were portrayed as harmful, most often it was not that scientists or science were intentionally being used to cause harm, or that a scientist was inherently malevolent. Dangerous portrayals often focused on the potential of science to cause or result in harmful and dangerous situations—unfortunate scientific accidents, as was the case in *Arsenal of Freedom*. This type of ‘science gone wrong’ portrayal was common in the dangerous and harmful portrayal of science and scientists. In *Sole Survivors (Sliders)* a weightloss drug worked well at first, but then unexpectedly turned people into flesh-eating zombies. In *Summer of Love (Sliders)* scientists created a wasp-like spider for agricultural pest control. The hybrid insect eventually became uncontrollable itself, and ravaged the land across continents.

A common association between beneficial and harmful portrayals was that science and scientists were often portrayed as both the cause and the solution to harmful situations or scientific accidents. For example, in *Sole Survivors (Sliders)* the same scientist who created the weightloss drug, worked tirelessly to find a vaccine, and eventually succeeded, but only after massive destruction and death had devastated the planet. Another association seen between harmful and beneficial portrayals was the conflict between the two. Sometimes the same science that was beneficial for one alien race or individual was harmful to others. For example, in *The Forgotten (Star Trek Enterprise)*, the crew tries to reason with an alien race that is changing the atomic and molecular structure of a section of outer space. The molecular changes will make the space inhabitable for their species, but will also make it uninhabitable for several other species already in residence, including Earth.

In response to the fourth research question, whether scientists and science are most often portrayed as beneficial or harmful and dangerous, findings here indicate that scientists are more often portrayed as beneficial (56%, N=60) rather than harmful and dangerous (25%, N=27). Science on the other hand, is portrayed as both beneficial (61%, N=66) and harmful (47%, N=51) in about half of all episodes (N=108) (see Table 4-13).

RQ 5

How have the representations of science and scientists changed over the last 20 years?

Time Trends Analysis Comparing 1987-1993, 1994-2000 and 2001-2007

The entire sample of episodes (N=108) covering a total of 21 years (1987-2007) was divided into three equal sections of seven years each: 1987-1993, 1994-2000 and 2001-2007. The earliest group of years, 1987-1993, contained the smallest number of episodes. Only 13% (N=14) of the sample (N=108) aired during 1987-1993. More than twice as many episodes aired

in the next group, 1994-2000 (31%, N=33). In 2001-2007, the number nearly doubled yet again, with 56% (N=61) of the sample (N=108) airing during the years 2001-2007 (see Table 4-14).

Number of episodes airing on cable vs. network channels

In the earliest group, 1987-1993, episodes were split evenly between cable and network channels; 50% (N=7) of the episodes aired on cable channels⁵ and 50% (N=7) aired on network channels⁶. In the next two groups, the number of episodes airing on cable channels increased, and the number airing on network channels decreased. In 1994-2000, 64% (N=21) aired on cable channels and the percentage of episodes airing on network dropped to 36% (N=18). This trend continued in 2001-2007, with 70% (N=43) of episodes airing on cable channels and only 30% (N=18) airing on network channels (see Table 4-15 and Figure 4-2).

Scientists

Overall, the portrayals of scientists changed very little. The gender of scientists was fairly consistent over the 21-year period analyzed. Male scientists were always more prevalent than female scientists. In 1987-1993 66% (N=19) of scientists were male versus 34% (N=10) female. The breakdown was slightly more balanced during the years 1994-2000, with 57% (N=32) male versus 43% (N=24) female. The numbers rebounded again during 2001-2007, with 65% (N=70) of scientists being male, and 35% (N=38) female (see Table 4-16). Overall, there were no significant changes in the gender of scientists over time (see Figure 4-3). Like gender, there were also no significant changes in the number of ethnic scientists over time. In all three time periods (1987-1993; 1994-2000; 2001-2007) the percentage of non-white scientists fluctuated only slightly between 14%-17% (see Table 4-17).

⁵ Cable channels included, the Sci-Fi Channel, TNT, UPN, WB, USA and first-run syndications.

⁶ Network channels included, FOX, NBC and ABC.

The personality of scientists did change over time, but only moderately. The scientist characters became progressively less agreeable and slightly more neurotic (see Figure 4-4). In 1987-1993, 38% (N=11) of scientists were agreeable in nature. In 1994-2000, only 30% (N=17) were agreeable, and in 2001-2007, the number of scientists with the personality trait of agreeableness dropped to 25% (N=27). While the agreeableness of scientists was decreasing, the trait of neuroticism was increasing. In 1987-1993 there were no scientists with the trait of neuroticism. In 1994-2000 2% (N=1) of scientist characters were considered neurotic, and in 2001-2007 the number of neurotic scientists jumped to 11% (N=12). The personality traits of openness and conscientiousness showed no significant fluctuation, and while the trait of extraversion did spike from 7% (N=2) during 1987-1993 to 20% (N=11) during 1994-2000, it fell back down to 8% (N=9) during 2001-2007.

The characterizations, age and physical appearance of scientists also remained fairly consistent across each seven-year time period. The characterization, regular guy/girl was dominant in each time period (see Table 4-18 and Figure 4-5). The average age of scientists fluctuated only slightly, with 30s and 40s being the dominant age groups across all three time periods (see Table 4-19). There was slightly more variation in the physical appearance of scientists over time, but the two dominant physical traits across all years was attractive, and neat and well-groomed (see Table 4-20 and Figure 4-6). The number of scientists wearing a uniform decreased slightly, from 59% (N=17) in both 1987-1993 and 1994-2000 (59%, N=33) to 42% (N=45) in 2001-2007. The decrease in the number of scientists in uniform was accompanied by a steady decrease in the number of scientists who carried or used a weapon, which dropped from 24% (N=7) in 1987-1993, to 11% (N=12) in 2001-2007.

The last category specific to scientists was the actual types of scientists, such as astronomer/physicist or computer scientist. There were no significant trends in the types of scientists portrayed in episodes over time, but there were significant fluctuations (see Table 4-21 and 4-7). For example, in 1987-1993, the representations of astronomers/physicists, doctors, and engineers was fairly balanced, with 21% (N=6) being astronomers/physicists, 24% (N=7) medical scientists or doctors, and 24% (N=7) engineers. In the next two time periods, 1994-2000 and 2001-2007, the three most prominent types of scientists were the same, but not nearly as balanced. In 1994-2000 astronomers/physicists made up 27% (N=15) of scientists and doctors made up 38% (N=21), but engineers dropped to only 11% (N=6). In 2001-2007, the distribution and the most three most prominent types of scientists changed. Astronomers/physicists dropped to 15% (N=17), doctors dropped to 31% (N=33), and engineers, still with 11% (N=6), were no longer one of the three most prominent types of scientists. Engineers were ousted by fictional/futuristic scientists, who made up 14% (N=15) of all scientist characters during the years 2001-2007.

Overall, the actual scientists in science fiction television shows have barely changed over the course of 21 years. The most significant change in the scientists portrayed in science fiction television shows over the last 21 years was the diversity of actual scientists. In 1987-1993, there were six different types of scientists portrayed in episodes: astronomers/physicists, medical, engineers, computer, anthropologists/archeologists, and fictional futuristic. In 1994-2000, there were seven different types of scientists, and in 2001-2007, there were nine different types of scientists seen in episodes (see Figure 4-7).

Science

Unlike the scientists, the different types of primary sciences⁷ seen in episodes over the 21-year period did not steadily increase in diversity, but the diversity did fluctuate. Eight different scientific disciplines were represented as the primary science in episodes during 1987-1993. The number jumped to 10 in 1994-2000, and back down to nine different sciences in 2001-2007 (see Table 4-22). Biology is the one scientific discipline present in both 1994-2000 and 2001-2007, that was not present as a primary science in the earliest years, 1987-1993.

In some cases, the actual number of episodes featuring a particular primary science fluctuated only slightly, but the percentages changed more dramatically. The reason for this is the varying number of episodes within each time period⁸. With this factor in mind, two trends stand out when looking at the primary sciences overtime. First, the number of episodes with astronomy/physics as the primary science steadily decreased. Second, there is spike in both paranormal and computer/technology sciences in 2001-2007 (N=61) (see Figure 4-9). In 1987-1993 (N=14), 29% (N=4) of episodes featured astronomy/physics as the primary science in the episode. That number dropped to 21% (N=7) in 1994-2000 (N=33), and to 11% (N=7) in 2001-2007 (N=61) (see Table 4-22). While the percentage of episodes with astronomy/physics as a primary science decreased, paranormal science increased. In 1987-1993 (N=14), 14% (N=2) of episodes featured paranormal science as the primary science in the episode. In 2001-2007 (N=61) the number of episodes doubled to 28% (N=17). Similarly, 14% (N=2) of the episodes in 1987-1993 (N=14) featured computer/technology as the primary science and 23% (N=14) in 2001-2007 (N=61) (see Table 4-22).

⁷ The primary science was the most prominent science portrayed in an episode; each episode had only one primary science, but may have had multiple secondary sciences.

⁸ Number of episodes per year: 1987-1993 (N=14); 1994-2000 (N=33); 2001-2007 (N=61)

Only one other notable change occurred in the most common primary sciences over time—a sharp decrease in the percentage of episodes featuring anthropology/archeology as the primary science (see Figure 4-9). In 1987-1993 (N=14), 14% (N=2) featured anthropology/archeology, in 1994-2000 (N=33) the number dropped to 3% (N=1), and to 2% (N=1) in 2001-2007 (N=61) (see Table 4-22).

Science fiction themes

Over the 21-year period, the primary themes in science fiction shows changed more dramatically than the sciences or the scientists (see Figure 4-9). Over the years, extra dimensions went from being a primary theme in 43% (N=6) of the episodes in 1987-1993 (N=14), to 12% (N=4) of episodes in 1994-2000 (N=33), and not present at all as primary theme in 2001-2007 (N=61) (see Table 4-23). While extra dimensions was slowly phased out as a primary theme, people and superhumans was phased in; 1987-1993 (N=14) had no episodes featuring people and superhumans as the primary theme, but in 2001-2007, 34% (N=21) of all episodes (N=61) featured this primary theme (see Table 4-23). Aliens and monsters also gained some momentum as a primary theme in both 1994-2000 and 2001-2007, and the last time period saw the emergence of an ‘other’ category to facilitate the primary theme in the show *Lost* (see Figure 4-9). Across all three time periods, space exploration and the military complex remained the dominant primary theme (see Figure 4-9).

Beneficial and harmful portrayals of scientists and science

Perhaps the most significant finding in the time trend analyses is the change in the harmful portrayals of science and scientists. Over the period of 21 years, there was clear increase in the harmful portrayals of science (see Figure 4-10). In 1987-1993 only 14% (N=2) of all episodes (N=14) portrayed science as harmful and dangerous. In 1994-2000, 45% (N=15) of the episodes

(N=33) portrayed science as harmful, and in 2001-2007 the number jumped again, with 56% (N=34) of all episodes in 2001-2007 (N=61) portraying science as harmful and/or dangerous (see Table 4-24). The harmful portrayals of scientists doubled from 14% (N=2) in 1987-1993 (N=14) to 33% (N=11) in 1994-2000 (N=33), but fell to 23% (N=14) in 2001-2007 episodes (N=66). The beneficial portrayals of science and scientists fluctuated only slightly from one time period to the next, hovering between 51-64% (see Table 4-24).

Overall, in 1987-1993 and 1994-2000 both science and scientists were portrayed as beneficial far more often than harmful, but in 2001-2007 the harmful portrayals of science (56%, N=34) nearly matched the beneficial portrayals of science (61%, N=37), and the harmful portrayals of science (56%, N=34) surpassed the beneficial portrayals of scientists (51%, N=31) (see Figure 4-10 and Table 4-24).

Research question five asked how the representations of science and scientists have changed over the last 20 years. Scientists have changed very little—their personality, characterizations and appearance have maintained a steady course. Science fiction television scientists are generally young, in their 30s or 40s, attractive, neat, and well-groomed. They are most often a conscientious and agreeable regular guy/girl who is indistinguishable from other characters. While their appearance and personality have changed very little, they do represent a slightly more diverse number of scientific disciplines. As for the actual science, computers and technology, and paranormal sciences are getting more attention in recent science fiction television shows, along with storylines about people with supernatural abilities and superhuman powers. The most significant change in science fiction television shows during 1987-2007 is frequency with which science is being portrayed as harmful and dangerous.

Table 4-1. Final sample of the 108 individual science fiction episodes.

Rank	Show Name	Episode Number	Season	Episode Title	Original Airdate	Network
1	Stargate SG-1	8	1	The Nox	09-12-97	showtime
		21	1	There But For the Grace of God	02-20-98	showtime
		125	6	Paradise Lost	01-08-03	sci-fi channel
		131	6	Prophecy	02-19-03	sci-fi channel
		210	10	Bad Guys	02-13-07	sci-fi channel
		212	10	Family Ties	02-27-07	sci-fi channel
2	X-Files	7	1	Ghost in the Machine	10-29-93	fox
		20	1	Darkness Falls	04-15-94	fox
		111	5	The Red and the Black	03-08-98	fox
		115	5	The Pine Bluff Variant	05-03-98	fox
		187	9	Lord of the Flies	12-16-01	fox
		200	9	Sunshine Days	05-12-02	fox
3	Star Trek - TNG	108	1	Justice	11-09-87	synd
		121	1	Arsenal of Freedom	04-11-88	synd
		402	4	Family	10-01-90	synd
		420	4	Qpid	04-22-91	synd
		710	7	Inheritance	11-22-93	synd
		712	7	The Pegasus	01-10-94	synd
4	Babylon 5	7	1	The War Prayer	03-09-94	tnt
		20	1	Babylon Squared	08-10-94	tnt
		62	3	Walkabout	09-30-96	tnt
		64	3	And the Rock Cried Out, No Hiding Place	10-14-96	tnt
		102	5	Meditations on the Abyss	05-27-98	tnt
		106	5	The Fall of Centauri Prime	10-25-98	tnt
5	Star Trek Deep Space Nine	103	1	Past Prologue	01-10-93	synd
		107	1	Q-Less	02-07-93	synd
		403	4	The Visitor	10-09-95	Synd

Table 4-1. Continued

	712	7	The Emperor's New Cloak	02-03-99	synd
6	Star Trek Voyager	103	1 Parallax	01-23-95	upn
	107	1	Eye of the Needle	02-20-95	upn
	402	4	The Gift	09-10-97	upn
	420	4	Vis à Vis	04-04-98	upn
	710	7	Flesh and Blood, Part 2	11-29-00	upn
	712	7	Lineage	01-24-01	upn
7	Battlestar Galactica	2	1 Water	01-14-05	sci-fi channel
	6	1	Litmus	02-11-05	sci-fi channel
	17	2	Resistance	01-31-06	sci-fi channel
	23	2	Pegasus	09-23-05	sci-fi channel
	51	3	The Son Also Rises	03-11-07	sci-fi channel
	53	3	Crossroads: Part 2	05-01-07	sci-fi channel
8	Farscape	7	1 PK Tech Girl	04-16-99	sci-fi channel
	20	1	The Hidden Memory (Part 2)	01-14-00	sci-fi channel
	62	3	Fractures	08-24-01	sci-fi channel
	64	3	Into the Lion's Den Part I: Lambs to the Slaughter	04-12-02	sci-fi channel
	68	4	What Was Lost Part I: Sacrifice	06-14-02	sci-fi channel
	86	4	We're So Screwed Part II: Hot to Katratzi	02-25-03	sci-fi channel
9	Stargate Atlantis	3	1 Hide and Seek	07-23-04	sci-fi channel
	7	1	Poisoning the Well	08-20-04	sci-fi channel
	58	3	Submersion	01-22-07	sci-fi channel
	60	3	First Strike (Part 1)	02-05-07	sci-fi channel
	62	4	Lifeline (Part 3)	10-05-07	sci-fi channel
	80	4	The Last Man (Part 1)	03-07-08	sci-fi channel
10	Smallville	7	1 Craving	11-27-01	wb
	20	1	Obscura	05-14-02	wb
	2	4	Gone	09-29-04	wb
	20	4	Ageless	05-04-05	Wb

Table 4-1. Continued

		10	7	Persona	01-31-08	wb
		12	7	Fracture	02-14-08	wb
11	Quantum Leap	102	1	Star-Crossed	03-31-89	nbc
		106	1	The Color of Truth	05-03-89	nbc
		318	3	Hunting We Will Go	04-18-91	nbc
		320	3	Heart of a Champion	05-08-91	nbc
		515	5	Blood Moon	02-09-93	nbc
		519	5	The Beast Within	03-16-93	nbc
12	Star Trek Enterprise	108	1	Breaking the Ice	11-07-01	upn
		121	1	Detained	04-24-02	upn
		318	3	Azati Prime	03-03-04	upn
		320	3	The Forgotten	04-28-04	upn
		402	4	Storm Front, Part II	10-15-04	upn
		420	4	Demons	05-06-05	upn
13	Lost	7	1	The Moth	11-03-04	abc
		20	1	Do No Harm	04-06-05	abc
		4	2	Everybody Hates Hugo	10-12-05	abc
		10	2	The 23rd Psalm	01-11-06	abc
		18	3	D.O.C.	04-25-07	abc
		20	3	The Man Behind the Curtain	05-09-07	abc
14	Sliders	3	1	Fever	03-29-95	fox
		6	1	Summer of Love	04-19-95	fox
		41	3	Sole Survivors	03-07-97	fox
		43	3	The Last of Eden	03-28-97	fox
		84	5	Heavy Metal	10-01-99	fox
		88	5	The Seer	02-04-00	fox
15	Firefly	2	1	The Train Job	09-20-02	fox
		6	1	Our Mrs. Reynolds	10-04-02	fox
16	Dark Angel	8	1	Cold Comfort	11-28-00	fox
		21	1	Meow	05-15-01	fox
		10	2	Brainiac	01-11-02	fox
17	Andromeda	7-107	1	The Ties That Bind	11-13-00	Synd

Table 4-1. Continued

	20-120	1	Star-Crossed	04-30-01	synd
	63-318	3	Deep Midnight's Voice	04-14-03	synd
	64-320	3	Twilight of the Idols	04-28-03	synd
	102-514	5	Pas is Prolix	02-04-05	synd
	106-518	5	Quantum Tractate Delirium	04-15-05	synd
18	Heroes	7	1 Nothing to Hide	11-06-06	nbc
		20	1 Five Years Gone	04-30-07	nbc
		27	2 The Kindness of Strangers	10-15-07	nbc
		33	2 Truth & Consequences	11-26-07	nbc
19	The 4400	3	1 The New an Improved Carl Morrissey	07-18-04	usa
		6	1 White Light	08-08-04	usa
		7	3 The Home Front	07-16-06	usa
		11	3 The Gospel According to Collier	08-13-06	usa
		2	4 Fear Itself	06-24-07	usa
		12	4 Tiny Machines	09-09-07	usa
20	Space - Above and Beyond	7	1 The Enemy	11-05-95	fox
		20	1 Stardust	04-19-96	fox

Table 4-2. Television stations airing the top 20 science fiction television shows: 1987-2007.

Cable or Network Station	# of Shows	% of Total
Sci-Fi Channel	23	21%
FOX	21	19%
Syndicated	18	17%
UPN	12	11%
NBC	10	9%
TNT	6	6%
WB	6	6%
USA	6	6%
ABC	6	6%

Note: First-run syndicated shows were coded as cable shows. Networks included FOX, ABC and NBC.

Table 4-3. Total number of scientist characters in all episodes.

Gender	White		Non-white		Unknown		Totals	
male	99	51%	16	8%	6	3%	121	63%
female	53	27%	13	7%	6	3%	72	37%
							193	100%

Note: Includes both alien and non-alien scientists. Of all scientist characters (N=193), 24% (N=46) were alien.

Table 4-4. Total number of alien scientist characters in all episodes.

Gender	White Alien		Non-white Alien		Unknown		Totals	
male	8	17%	0	0%	6	13%	14	30%
female	14	30%	12	26%	6	13%	32	70%
							46	100%

Table 4-5. Personality traits of scientist characters.

Personality trait	Primary		Secondary	
	Conscientiousness	100	52%	14
Agreeableness	55	28%	40	21%
Extraversion	22	11%	14	7%
Neuroticism	13	7%	5	3%
Openness	3	2%	56	29%

Note: All scientists (N=193) had a primary personality trait; 52% (N=101) also exhibited one or two secondary personality traits. No scientists exhibited four or five personality traits.

Table 4-6. Primary and Secondary characterizations of scientists.

Characterization	Primary		Secondary	
	Regular guy/girl	147	76%	15
Genius	25	13%	25	13%
Hero	7	4%	16	8%
Nerd	6	3%	7	4%
Mad Scientist	6	3%	0	0%
Comedian	1	1%	16	8%
Charmer	1	1%	2	1%
	193	100%		

Note: All scientists (N=193) exhibited a primary characterization; 35% (N=68) also exhibited one or more secondary characterizations.

Table 4-7. Physical appearance of scientists.

Attribute	Number of Scientists with Attribute	
Neat/groomed	167	87%
Attractive	137	71%
Uniform	95	49%
Symbols of Knowledge	68	35%
Other	47	24%
Weapon	27	14%
Glasses	26	13%
Lab coat or attire	17	9%
Messy	5	3%
Pocket protector	0	0%

Table 4-8. Average age of scientists.

Age	Number of Scientists	
Under 20	0	0%
20s	18	9%
30s	103	53%
40s	59	31%
Over 50	8	4%

Note: It was not possible to estimate the age of five scientists, all of which were alien.

Table 4-9. Most frequently portrayed scientists.

Scientist	Male		Female		Totals	
Medical	35	29%	26	36%	61	32%
Astronomer/Astrophysicist/Physicist	29	24%	9	13%	38	20%
Engineer	18	15%	7	10%	25	13%
Fictional or Futuristic	10	8%	14	19%	24	12%
Social Scientists/Other	6	5%	7	10%	13	7%
Biologist/Botanist/Chemist	6	5%	6	8%	12	6%
Archeologist	6	5%	3	4%	9	5%
Computer Scientist	9	7%	0	0%	9	5%
Geologist/Ecologist	2	2%	0	0%	2	1%
	121	100%	72	100%	193	100%

Note: Some scientist characters are portrayed as more than one type of scientist. These figures reflect what was judged to be the most dominant science practiced by the character—the primary type of science.

Table 4-10. Amount of science portrayed in each episode.

	A lot		Some		Very little	
How much science	52	48%	25	23%	30	28%

Table 4-11. Most frequently portrayed sciences.

Science	Primary		Secondary		Total # of episodes portraying the science	
Paranormal	23	21%	9	8%	32	30%
Computers and Technology	19	18%	45	42%	64	59%
Astronomy, Astrophysics, Physics	18	17%	35	32%	53	49%
Medical	11	10%	40	37%	51	47%
Biology, Botany, Chemistry	9	8%	28	26%	37	34%
Engineering	7	6%	26	24%	33	31%
Fictional or Futuristic	6	6%	64	59%	70	65%
Geology	5	5%	5	5%	10	9%
Social Sciences/Other	5	5%	8	7%	13	12%
Anthropology, Archeology	4	4%	5	5%	9	8%
	108	100%				

Note: The most prominent science portrayed in the episode was coded as the primary science. All episodes (N=108) portrayed one primary science; 85% (N=92) also portrayed one or more secondary sciences.

Table 4-12. Most prominent science fiction themes.

Theme	Primary		Secondary		Total # of episodes with this theme	
Space exploration and the military complex	60	56%	4	4%	64	59%
People and superhumans	22	20%	1	1%	23	21%
Extra dimensions	10	9%	15	14%	25	23%
Aliens and monsters	8	7%	38	35%	46	43%
Other	6	6%	0	0%	6	6%
Future or alternate human societies	1	1%	58	54%	59	55%
Robots, computers and gadgets	1	1%	13	12%	14	13%
	108	100%				

Note: 71% (N=77) of episodes had one or more secondary themes.

Table 4-13. Harmful vs. beneficial portrayal of science and scientists.

	Beneficial		Harmful	
	Count	Percentage	Count	Percentage
Science	66	61%	51	47%
Scientists	60	56%	27	25%

Table 4-14. Final sample of 108 episodes divided into seven year sections based on airdate.

Channels	1987-1993		1994-2000		2001-2007	
	Count	Percentage	Count	Percentage	Count	Percentage
Sci-Fi Channel	0	0%	4	12%	19	31%
FOX	1	7%	12	36%	8	13%
TNT	0	0%	6	18%	0	0%
UPN	0	0%	5	15%	7	11%
WB	0	0%	0	0%	6	10%
NBC	6	43%	0	0%	4	7%
ABC	0	0%	0	0%	6	10%
USA	0	0%	0	0%	6	10%
Syndicated	7	50%	6	18%	5	8%
	14	13%	33	31%	61	56%

Note: 13% of all episodes (N=108) aired in 1987-1993, 31% aired in 1994-2000, and 56% aired in 2001-2007.

Table 4-15. Percentage of episodes airing on network vs. cable channels over time.

Channels	1987-1993		1994-2000		2001-2007	
	Count	Percentage	Count	Percentage	Count	Percentage
Network	7	50%	12	36%	18	30%
Cable	7	50%	21	64%	43	70%
	14	13%	33	31%	61	56%

Note: Network channels included, FOX, NBC and ABC, cable channels included, Sci-Fi Channel, TNT, UPN, WB, USA, and first run syndications.

Table 4-16. Number and gender of scientists over time.

Gender	1987-1993		1994-2000		2001-2007	
Male	19	66%	32	57%	70	65%
Female	10	34%	24	43%	38	35%
	29	15%	56	29%	108	56%

Note: total number of scientists in all episodes was 193.

Table 4-17. Percentage of non-white scientists over time.

	1987-1993		1994-2000		2001-2007	
Male (non-white)	5	17%	3	5%	8	7%
Female (non-white)	0	0%	5	9%	8	7%
	5	17%	8	14%	16	15%

Table 4-18. Characterizations of scientists over time.

	1987-1993		1994-2000		2001-2007	
Comedian	0	0%	0	0%	1	1%
Nerd	0	0%	0	0%	6	6%
Mad Scientist	0	0%	1	2%	5	5%
Hero	0	0%	3	5%	4	4%
Charmer	0	0%	0	0%	1	1%
Genius	4	14%	9	16%	12	11%
Regular guy/girl	25	86%	43	77%	79	73%

Table 4-19. Age of scientists over time.

	1987-1993		1994-2000		2001-2007	
Under 20	0	0%	0	0%	0	0%
20s	0	0%	11	20%	7	7%
30s	18	62%	23	43%	62	59%
40s	9	31%	19	35%	31	30%
Over 50	2	7%	1	2%	5	5%

Note: It was not possible to estimate the age of five scientists, all of which were alien.

Table 4-20. Physical appearance of scientists over time.

	1987-1993		1994-2000		2001-2007	
Glasses	1	3%	10	18%	15	14%
Lab coat or attire	0	0%	4	7%	13	12%
Pocket protector	0	0%	0	0%	0	0%
Weapon	7	24%	8	14%	12	11%
Uniform	17	59%	33	59%	45	42%
Symbols of Knowledge	7	24%	20	36%	41	38%
Neat/groomed	28	97%	50	89%	89	82%
Messy	1	3%	2	4%	2	2%
Attractive	20	69%	38	68%	79	73%
	29		56		108	

Table 4-21. Most frequently portrayed types of scientists over time.

	1987-1993		1994-2000		2001-2007	
Astronomer, Physicists	6	21%	15	27%	17	15%
Biologist, Botanist, Chemist	0	0%	4	7%	8	7%
Geologist	0	0%	0	0%	2	2%
Medical	7	24%	21	38%	33	31%
Engineer	7	24%	6	11%	12	11%
Computer	1	3%	0	0%	8	7%
Other or Unknown	0	0%	3	4%	10	5%
Anthropologist, Archeologist	3	10%	3	5%	3	3%
Fictional or Futuristic	5	17%	4	7%	15	14%
	29		56		108	

Note: Some scientist characters are portrayed as more than one type of scientist. These figures reflect what was judged to be the most dominant science practiced by the character—the primary type of science.

Table 4-22. Most common primary science portrayed in episodes over time.

	1987-1993		1994-2000		2001-2007	
Astronomy, Physics	4	29%	7	21%	7	11%
Biology, Botany, Chemistry	0	0%	3	9%	6	10%
Geology	1	7%	1	3%	3	5%
Medical	1	7%	4	12%	6	10%
Engineering	0	0%	4	12%	3	5%
Computer/Technology	2	14%	3	9%	14	23%
Other	1	7%	5	15%	0	0%
Anthropology, Archeology	2	14%	1	3%	1	2%
Fictional or Futuristic	1	7%	1	3%	4	7%
Paranormal	2	14%	4	12%	17	28%
	14	13%	33	31%	61	56%

Note: The primary science was the most prominent science portrayed in an episode. Often there was more than one type of science portrayed in an episode, but there was only one primary type of science per episode.

Table 4-23. Primary science fiction theme portrayed in an episode.

	1987-1993		1994-2000		2001-2007	
Space exploration and the military complex	7	50%	23	70%	29	48%
Aliens and monsters	0	0%	3	9%	5	8%
Future or alternate human societies	0	0%	1	3%	0	0%
People and superhumans	0	0%	1	3%	21	34%
Robots, computers and gadgets	1	7%	0	0%	0	0%
Extra dimensions	6	43%	4	12%	0	0%
Government conspiracy and cover-ups	0	0%	1	3%	0	0%
Other	0	0%	0	0%	6	10%
	14	13%	33	31%	61	56%

Note: The primary theme is the most prominent theme in an episode. Often there was more than one theme seen in an episode, but all episodes had only one primary theme.

Table 4-24. Beneficial and harmful portrayals of scientists and science.

	1987-1993		1994-2000		2001-2007	
Science beneficial	8	57%	21	64%	37	61%
Science harmful	2	14%	15	45%	34	56%
Scientists beneficial	8	57%	21	64%	31	51%
Scientists harmful	2	14%	11	33%	14	23%

Note: Scientists and/or science were sometimes portrayed as both harmful and beneficial in the same episode, and sometimes they were portrayed as neither harmful nor beneficial.

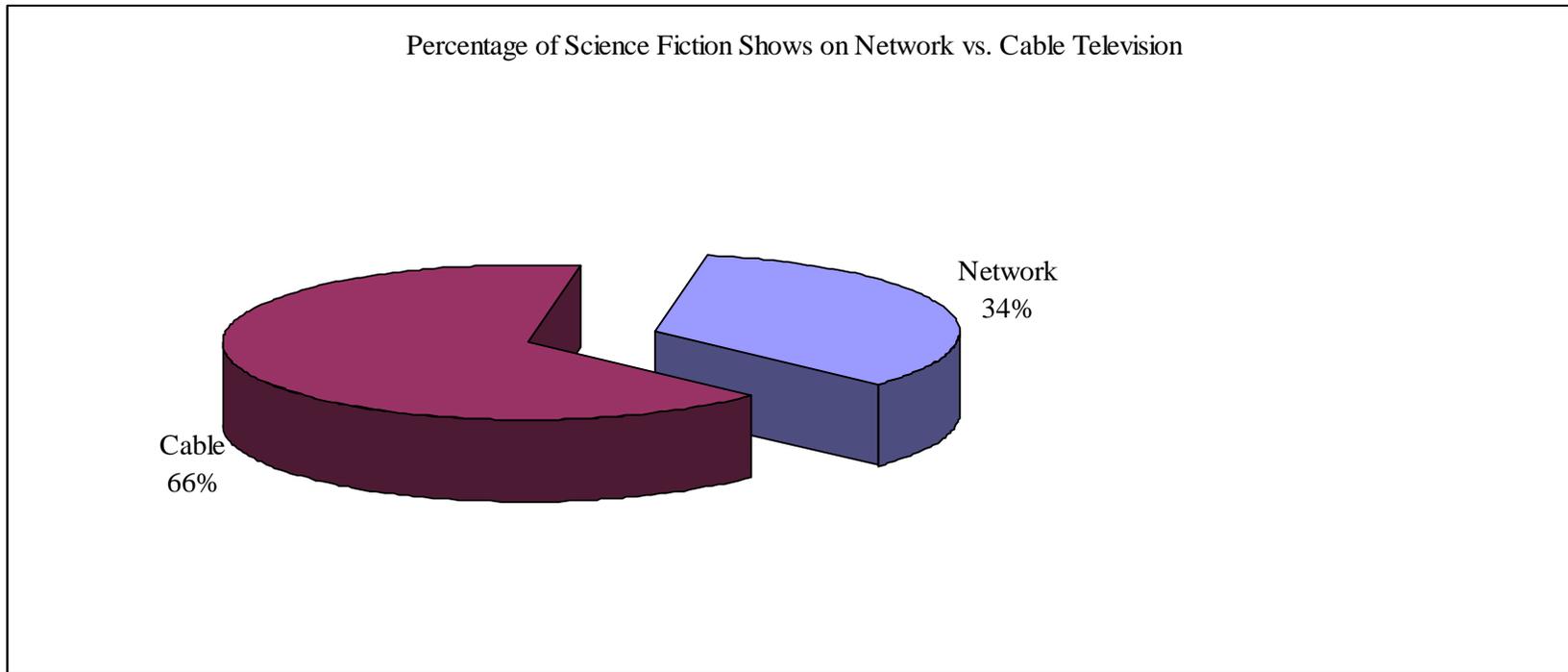


Figure 4-1. Percentage of science fiction episodes airing on network versus cable television during 1987-2007.

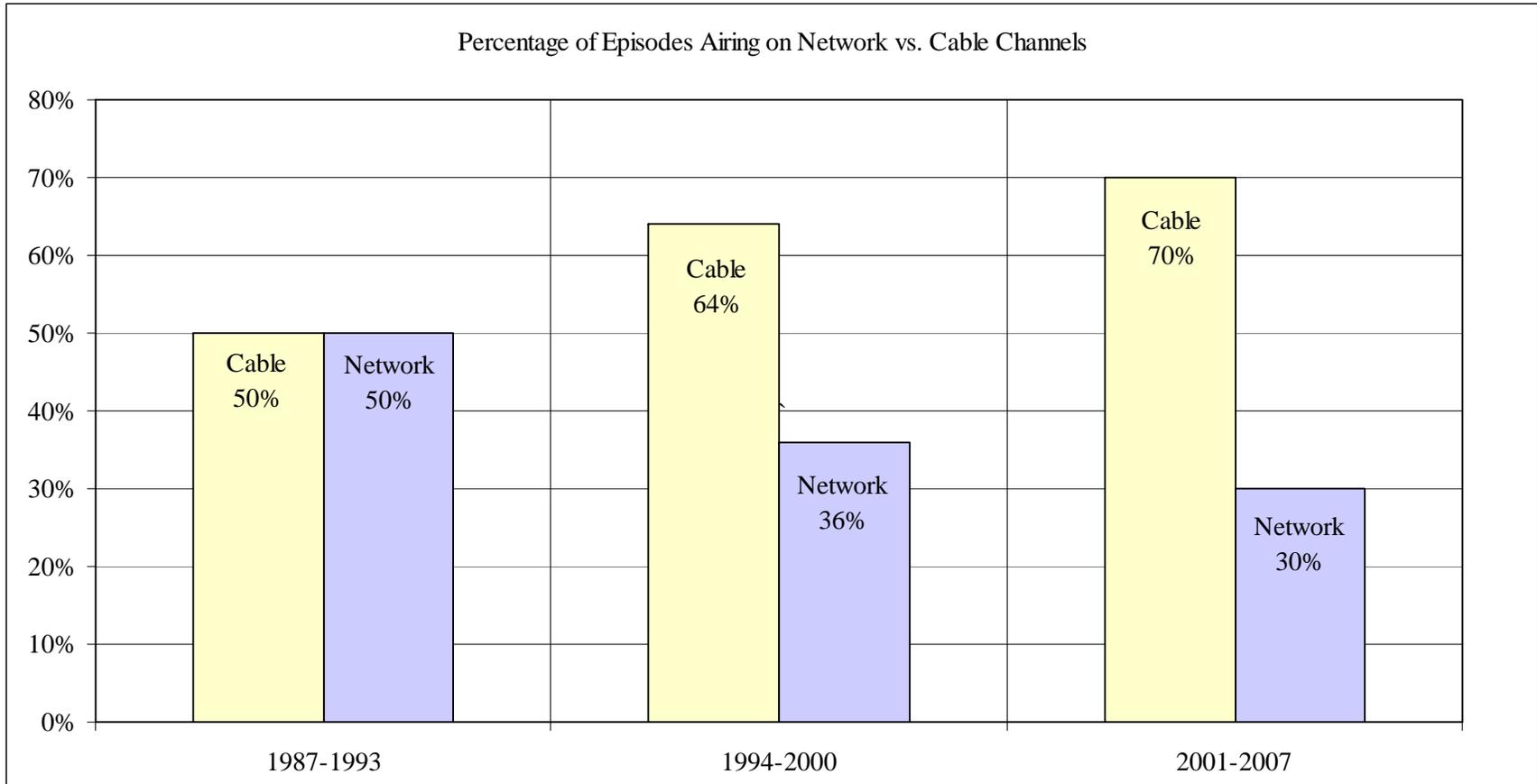


Figure 4-2. Percentage of science fiction shows airing on network versus cable television over time.

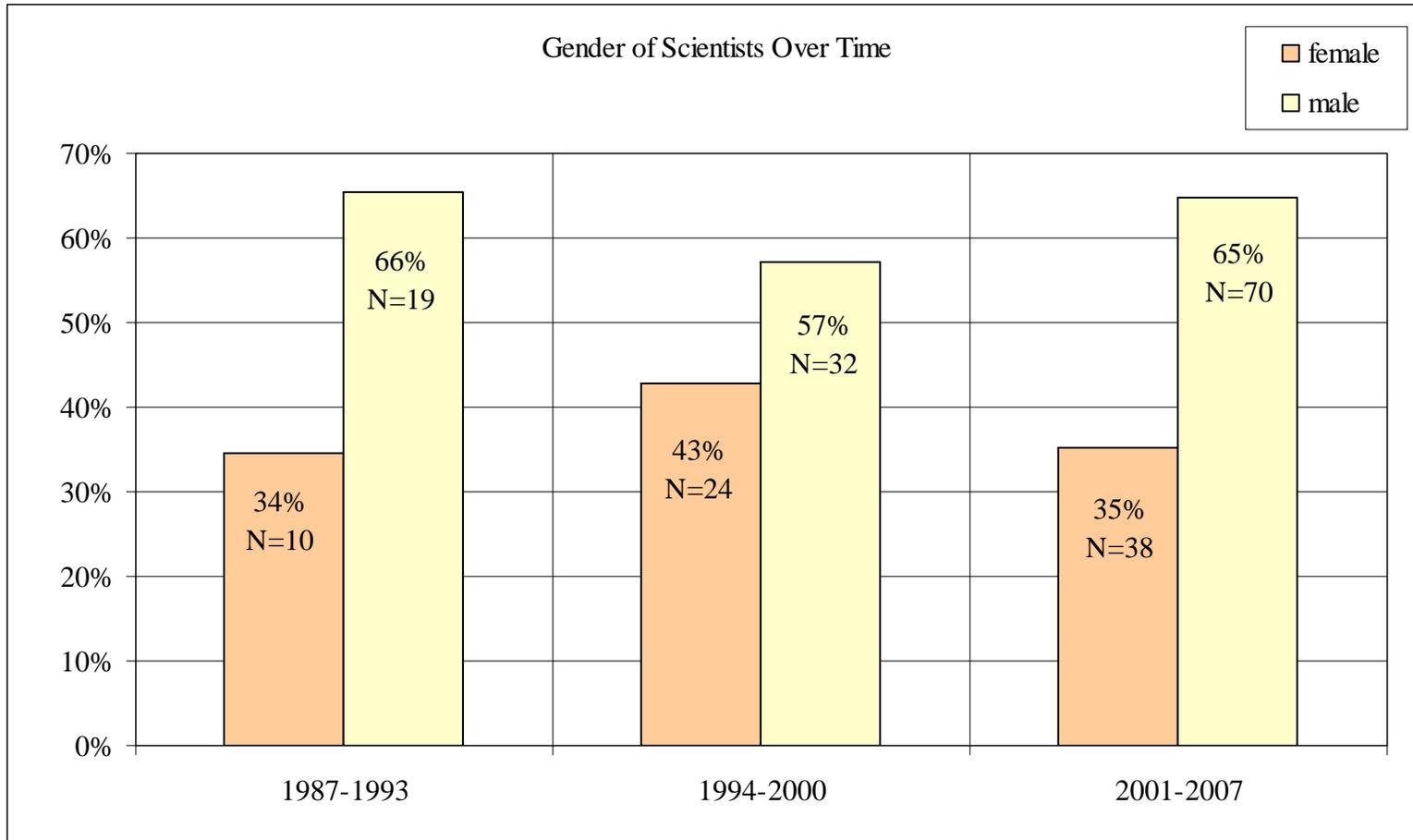


Figure 4-3. Gender of scientists over time.

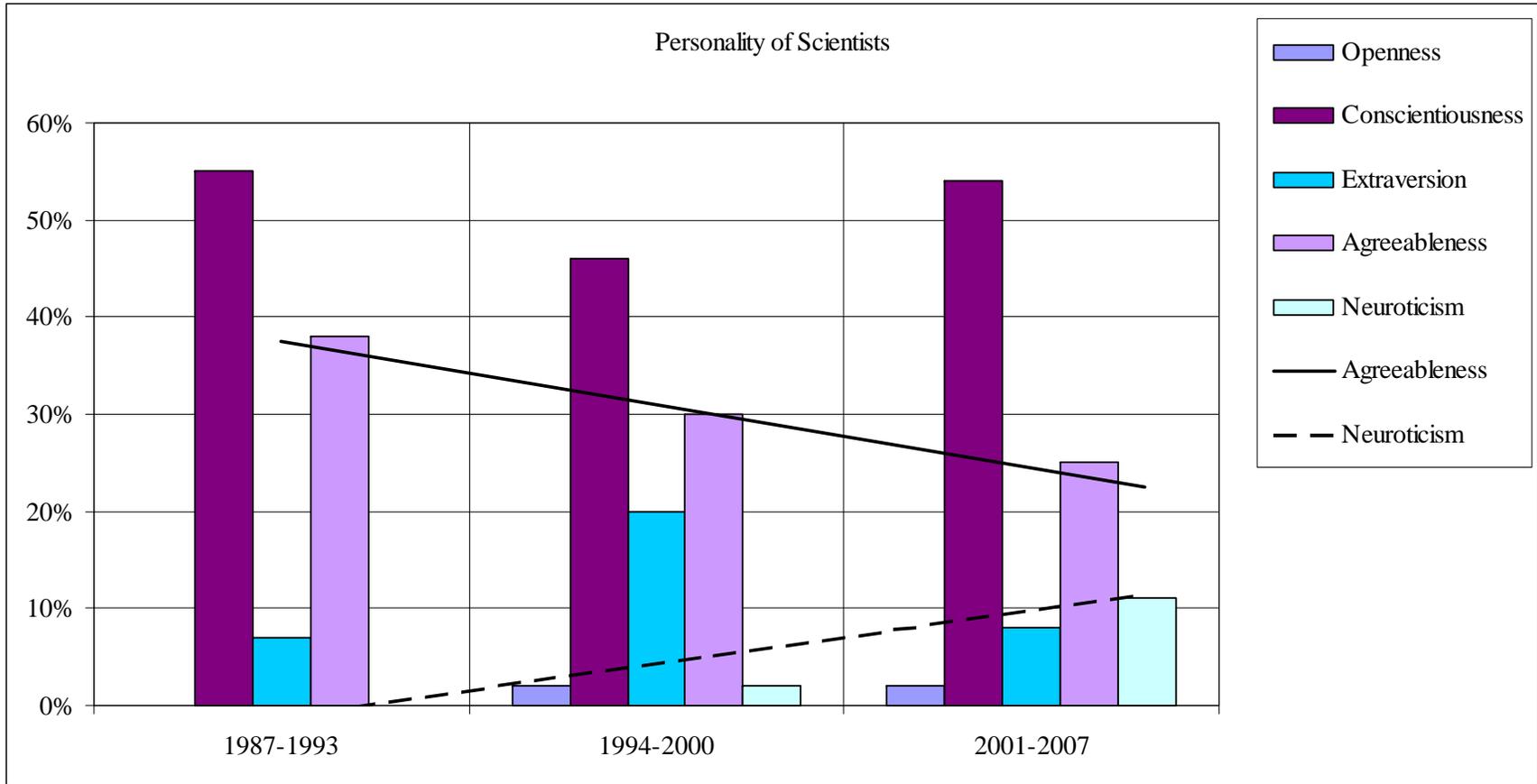


Figure 4-4. Personality of scientists over time.

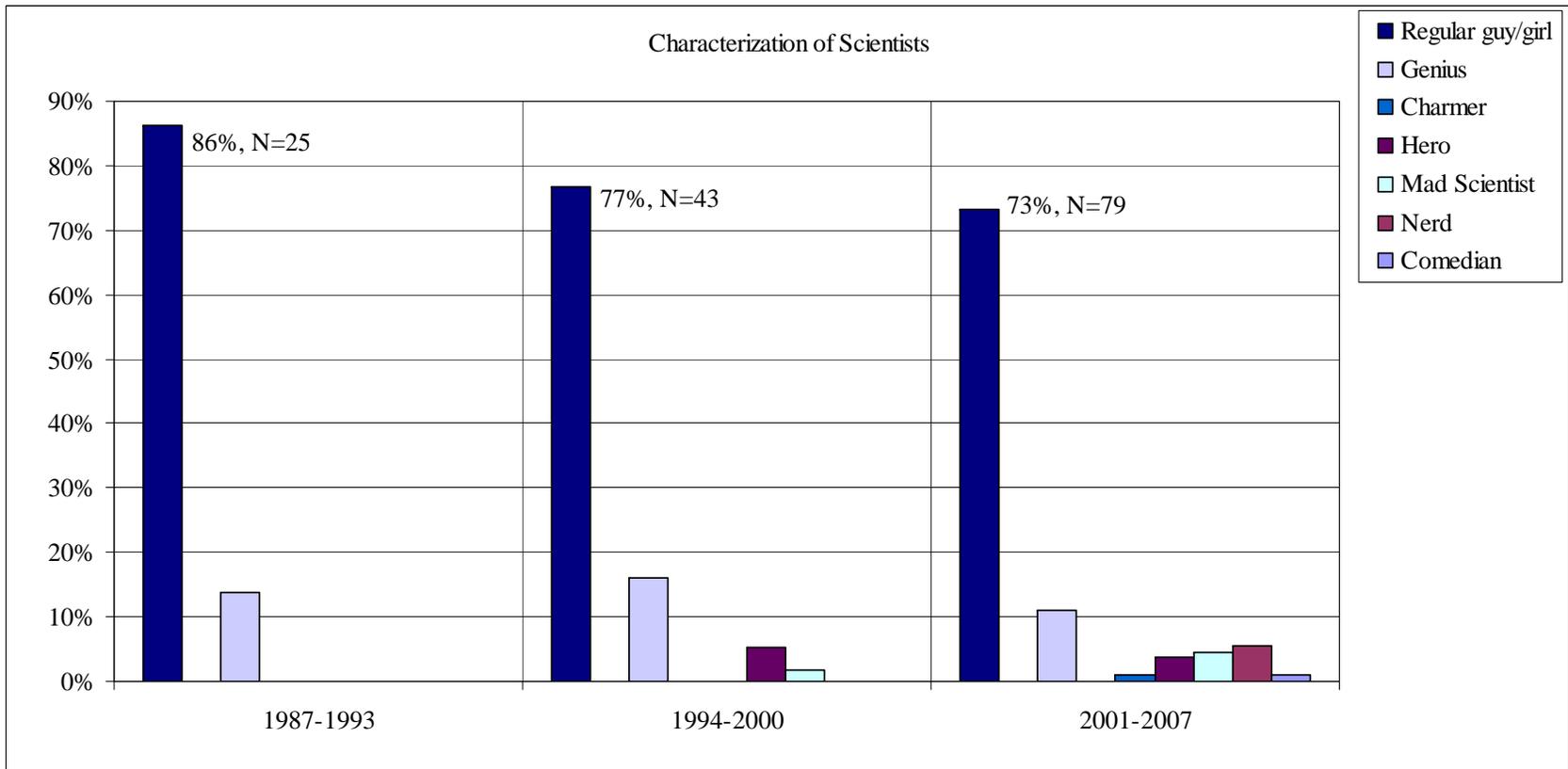


Figure 4-5. Characterization of scientists over time.

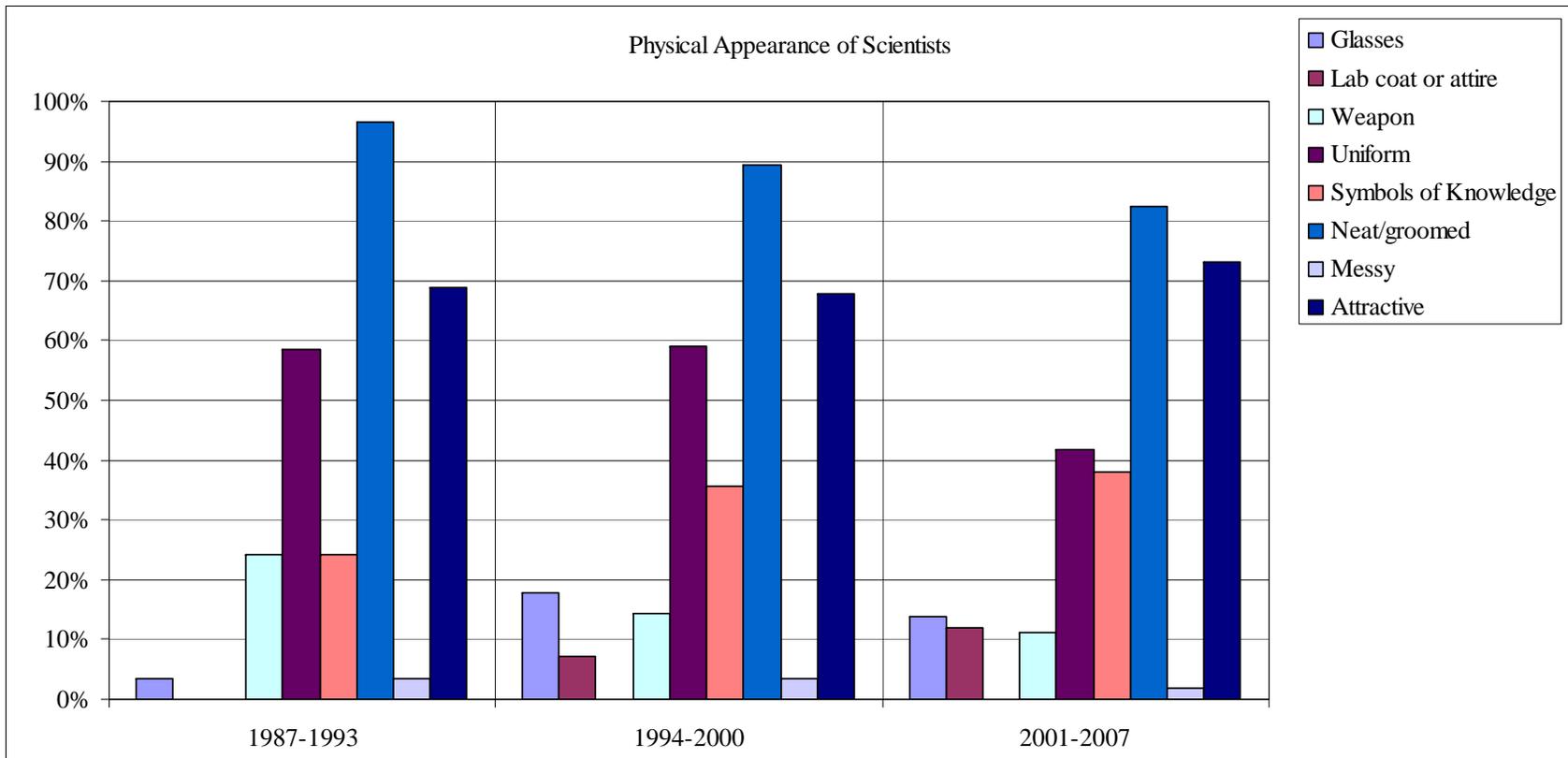


Figure 4-6. Physical appearances of scientists over time.

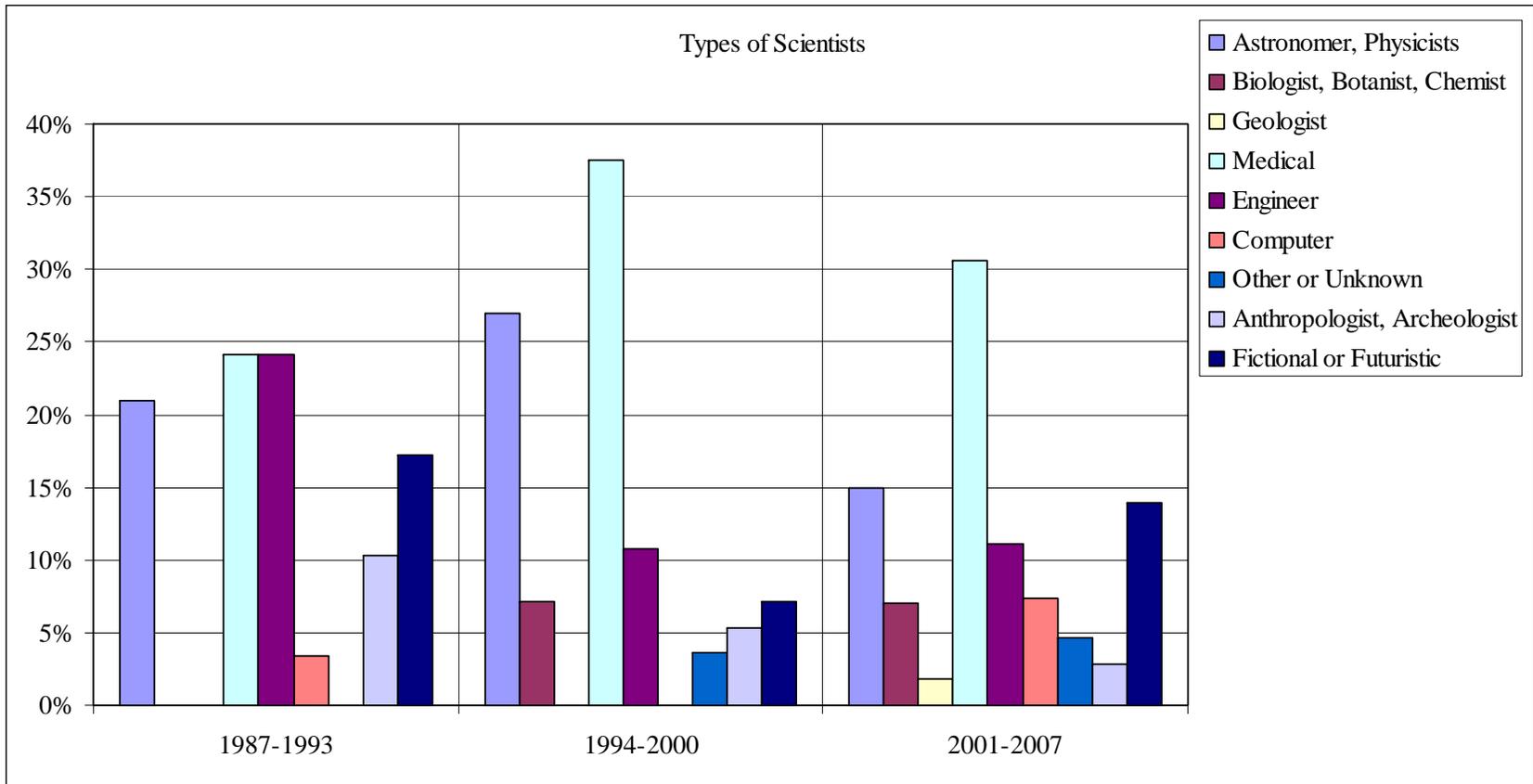


Figure 4-7. Most frequently portrayed types of scientists over time.

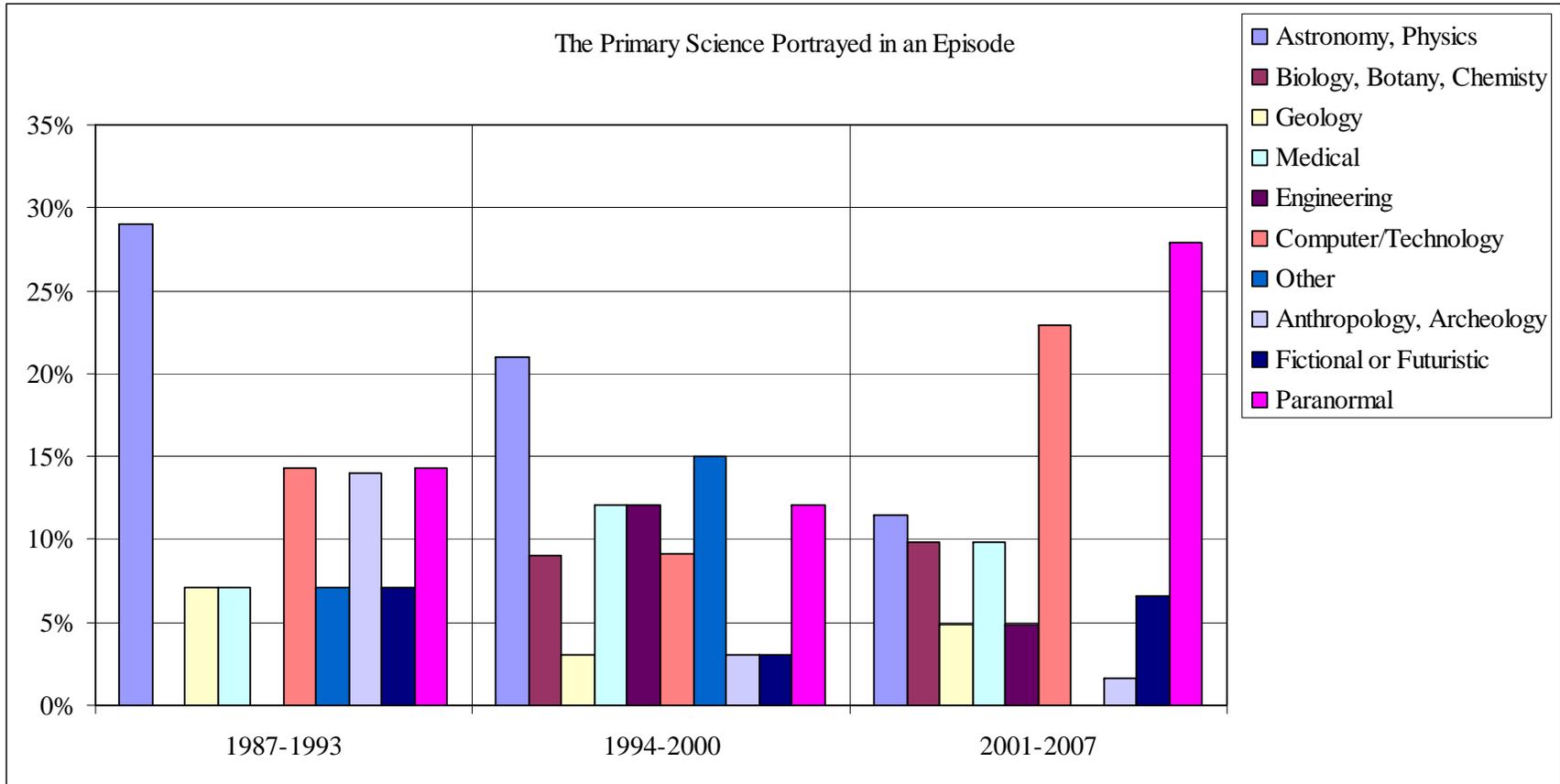


Figure 4-8. The most common primary sciences portrayed in episodes over time.

Note: The primary science was the most prominent science portrayed in an episode. Often there was more than one type of science portrayed in an episode, but there was only one primary type of science per episode.

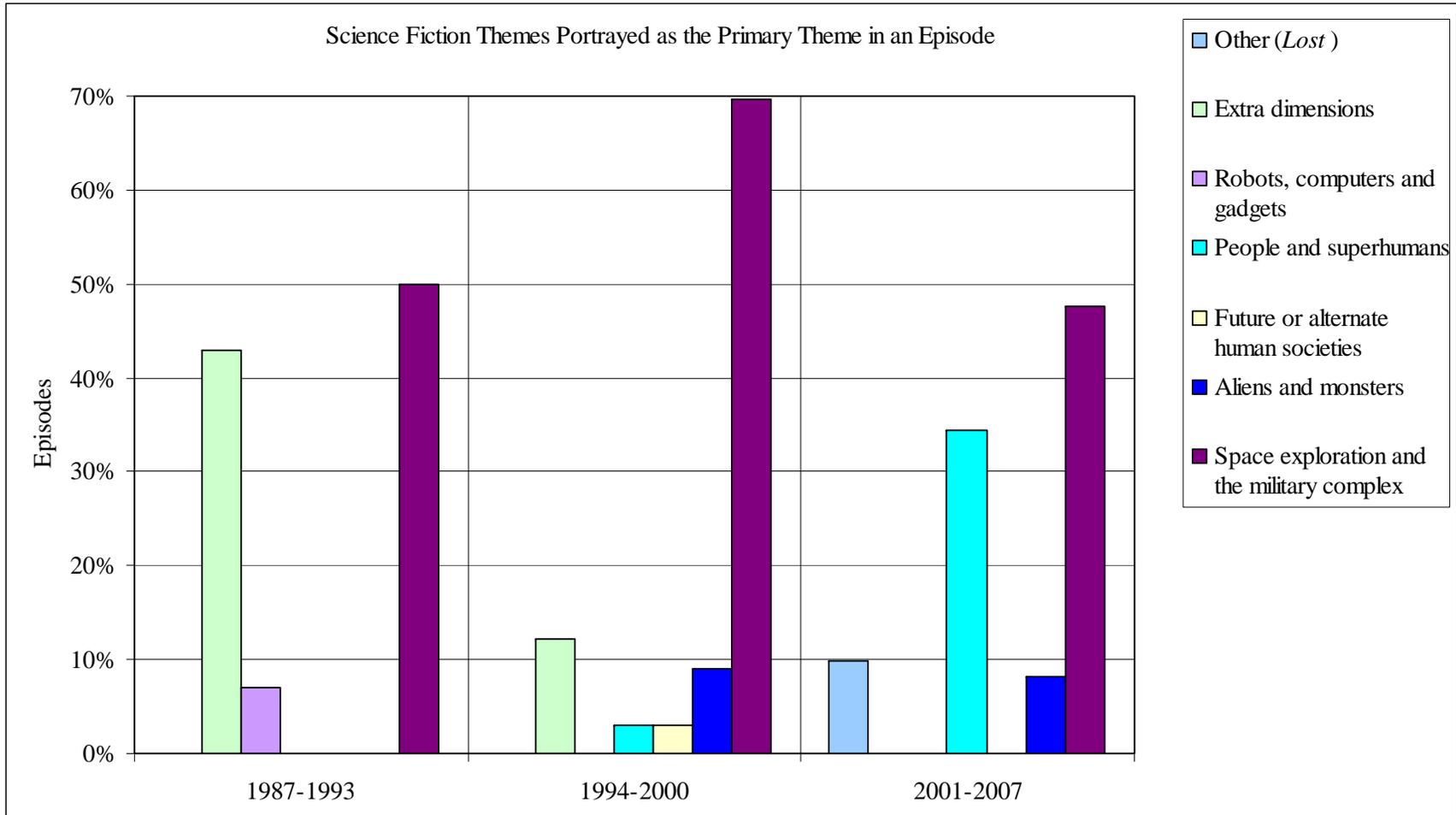


Figure 4-9. Most common primary science fiction themes over time.

Note: The primary theme is the most prominent theme in an episode; all episodes had only one primary theme.

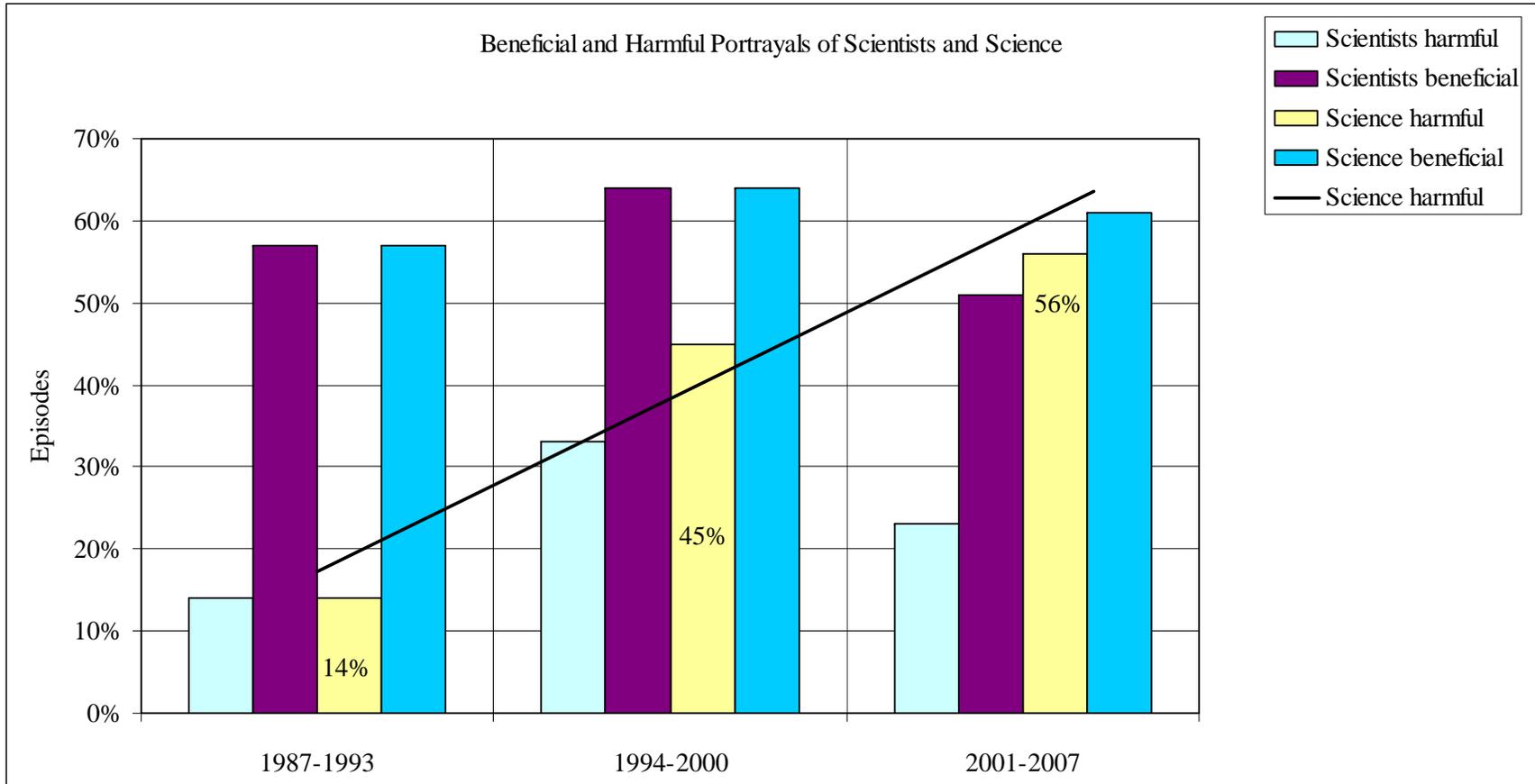


Figure 4-10. Beneficial and harmful portrayals of scientists and science.

CHAPTER 5 DISCUSSION AND CONCLUSION

The primary goal of this study was to answer questions about how science and scientists are represented in modern science fiction television. Previous research was used to establish how fictional science and scientists have been portrayed in the past, and how researchers believed those portrayals were changing. The findings of this study make it possible to discuss the potential implications of current representations, and to confirm or refute the changes anticipated by previous researchers.

Popularity of Science Fiction Television

One of the major points of significance for carrying out a study focused on the representations of science and scientists in science fiction television is the increasing popularity of science fiction television shows (Frutkin, 2006; Sconce, n.d.; Umstead, 2007). The literature discussing this growing popularity can now be confirmed by actual data—the number of episodes that aired during 2001-2007 was more than quadruple the number that aired between 1987 and 1994. It could be argued that the more popular shows—the higher ranking shows—would be the most recent shows, which would explain the greater number of episodes in more recent years. However, three of the top five most popular shows (*Star Trek: The Next Generation*, *Babylon 5* and *Star Trek Deep Space Nine*) were not aired during the more recent years, 2001-2007. While cable consistently aired more science fiction than network channels, the number of shows on network channels did increase over time, from only seven in 1987-1993 to 18 shows in 2001-2007. This is clear support for the literature claiming that the number of science fiction shows on television is steadily increasing, and that the network channels are no longer shying away from science fiction to draw in viewers (Frutkin, 2006; Umstead, 2007).

As the amount of science fiction on television increases, science fiction content is reaching a greater number of people. More science fiction entertainment on television means more of the two things central to science fiction: science and scientists. Because the representations or misrepresentations of science and scientists in science fiction are reaching larger audiences, those portrayals have an increasing potential to influence the way that people think about science and scientists (Gerbner & Gross, 1976).

Representations of Scientists

The first research question examined representations of scientists. The dominant representation of scientists is the summation of various traits, including gender, ethnicity, personality, characterization, age and physical appearance. The dominant representations of scientists were found to be generally positive, and these representations have changed very little over time. Just as Lambourne, Shallis & Shortland (1990) predicted, the mad scientist character of the 1950s has been replaced by a regular guy/girl scientist who is almost always indistinguishable from other characters. Scientists in modern science fiction television are not antisocial loners working in isolated labs; they are well-groomed, attractive and likeable characters most often seen working as part of a team. The stereotypical mad, evil and nerdy scientists discussed by Lambourne, Shallis & Shortland (1990) and Frayling (2005) appear to be a thing of the past. In this study's analysis of science fiction television, the stereotypical nerdy, genius scientist with glasses was seen only once in 108 episodes. In all other cases when scientists were characterized as nerds (N=11), they were neat and well-groomed, and they did not wear glasses or a pocket protector. The dominant physical traits of scientists in modern science fiction television strengthen this regular guy/girl image, which appears to have replaced old the stereotypes. The dominant personality traits of agreeableness and conscientiousness further

strengthen this regular guy/girl image, and push the mad and evil scientist stereotypes further into the past. This new image of the fictional scientist as a young, attractive and well-groomed regular guy/girl whose actions are fueled by positive morals and ethics, could serve to create positive perceptions of scientists and careers in science.

As art and entertainment often do imitate life, it is possible that the prevalent regular guy/girl images of scientists may be a reflection of changing social ideas and perceptions of scientists and science. Weingart (2003) believed that unfavorable characterizations of science and scientists in Hollywood films increase the “distance” between science and the public. If the characterizations of fictional screen scientists influence the virtual “distance” between science and the public, then it would seem that the overwhelming presence of the regular guy/girl scientist in science fiction television certainly has the potential to shorten that distance, making science more accessible to the non-scientist.

In addition, these findings could increase the usefulness of science fiction in the classroom. As previously discussed, the decline in student interest in science and engineering careers will result in a shortage of scientists and engineers (NSF, 2002; Osborne, Simon & Collins, 2003), but it is possible that science fiction television could help to boost that student interest. In addition to the many documented uses of science fiction to teach and inspire students¹, the positive portrayals of scientists in science fiction television could help teachers introduce students to scientists who are accessible in appearance and demeanor.

Gender

Although the overall portrayals of scientists are generally positive, two traits of science fiction scientists are not evenly balanced: gender and ethnicity. The gender of science fiction

¹ See Czerneda, 1999; Cavanaugh & Cavanaugh, 1996; Dubeck, Moshier, & Boss, 1988; Efthimiou & Llewellyn 2004; Fraknoi, 2003; Martin, 1979; Negrete & Lartigue, 2004; Reynolds, 1977; Rose, 2007; Zander, 1974.

scientists is not balanced between male and female—females are underrepresented as scientists in science fiction (see Figure 4-3). The years 1994-2000 saw a slight improvement to this imbalance, but in recent years (2001-2007) only 35% (N=38) of all scientist characters were women. The gender imbalance in science fiction television shows mirrors the student perceptions of scientists found by two separate studies. The “draw-a-scientist” test was first used by Chambers in 1983. Of the 4807 elementary school aged children asked to draw a scientist, less than 1% drew a female scientist. The test was used again by Barman in 1997; of the 1504 middle school students who drew their conception of a scientist, only 25% drew a female. Additionally, the drawings of scientists submitted in Barman’s (1997) study were predominantly of white males dressed in lab coats and wearing glasses. The reality in the U.S. is that the majority of college educated workers in science and engineering occupations are male. Only 26% of science and engineering occupations are filled by woman (NSF, 2008). This imbalance has prompted decades of research and possible solutions to bolster interest in science careers among women (Jones, Howe & Rua, 2000). While modern science fiction television shows could be useful in familiarizing students with the regular guy/girl scientist, they also portray the imbalance between men and women in science careers. However, when looking at the percentage of woman in science and engineering careers (26%) compared to the number of female scientists in science fiction television shows (35%), science fiction very nearly mirrors reality. Ironically, women have stronger numbers in the science in science fiction television than they do in real science.

Ethnicity

Ethnic minorities are underrepresented in science fiction television shows when compared to the actual number of ethnic minorities working in science and engineering careers. According

the most recent biannual Science and Engineering Indicators report, ethnic minorities² make up 24% of the science and engineering workforce in the U.S. In science fiction television shows, only 15% of the scientists are ethnic, or not white. Interestingly, the gender of ethnic science fiction scientists was very well balanced, with 8% (N=16) being male and 7% (N=13) being female. However, of the 13 ethnic female scientists, 12 were aliens. No ethnic male scientists were alien. This representation of ethnic female scientists as aliens can be interpreted in a number of ways. These portrayals might suggest the alienation of female ethnic scientists—that ethnic female scientists are outsiders. On the other hand, every ethnic female scientist who was an alien was also very attractive and often in an elaborate and revealing costume. Perhaps ethnic females are simply better suited to portray exotic alien beauties. Alternatively, maybe these attractive, ethnic female scientists in sexy costumes subjugate ethnic women in science, making the career seem far away and out of reach for young ethnic women considering their career options.

Aside from the gender and ethnic imbalances, the images of scientists in American science fiction television are broadcasting a generally positive message about scientists. Unlike Weingart's (2003) finding in his analysis of Hollywood films, the scientists in science fiction television are not characterized by "uneasiness" and "distrust." With the exception of imbalanced representations in gender and ethnicity, the regular guy/girl scientists with their conscientious and agreeable personalities could be considered positive role models for inspiring both student and public interest in science. However, if a science teacher intends to use science fiction television as a tool for inspiring interest and introducing students to favorable images of scientists, they may want to choose specific science fiction television shows that include

² Ethnic minorities as defined by the National Science Board includes, Asians, Pacific Islanders, African Americans, Hispanics, and other ethnicities including American Indians/Alaska Natives (NSF, 2008).

portrayals of both white and non-white female scientists who are not dressed in costumes that might be considered objectifying. *Star Trek: The Next Generation*, *Star Trek Enterprise*, *Stargate SG-1* and *Stargate Atlantis* are a few examples of science fiction television shows with female scientists who are conservatively and casually dressed.

Representations of Science

The second and third research questions examined the actual science—the types of science portrayed and the themes surrounding that science. Previous research (Nicholls, 1983; Lambourne, 1990) found physics, astronomy and space exploration to be the dominant sciences in science fiction. Modern science fiction television is no exception to this past trend. Physics and astronomy take center stage along with medical sciences, and these sciences are most often immersed in themes of space exploration and the military complex. Lambourne (1990) also correctly predicted an increase in the presence of technology and computers in science fiction stories. Most likely, as Lambourne hypothesized, the jump in computer and technology sciences can be attributed to the Internet boom and the increasing presence of technology in daily life. As computers and technology continue to permeate nearly every facet of home life and the workplace, these sciences will likely continue their increasing presence not only in science fiction, but in other television genres as well. Individuals who regularly watch science fiction will build a familiarity with these sciences and the associated terminology (Czerneda, 1999). Whether through real or imaginary sciences, this increased familiarity with computers, technology and the associated vocabulary may actually improve an individual's comfort with the increasingly complicated technology that surrounds us. As noted by Czerneda (1999), recognizing the words and vocabulary of science is an essential component of science literacy.

While frequent science fiction viewers may be improving literacy through familiarity, the same images and representations of fictional science and scientists could also be influencing opinions and beliefs about real science. More often than not, the military was a prominent element in science fiction episodes. The overarching theme of space exploration and the military complex was seen more than twice as often as the next most common theme, people and superhumans. Even when episodes did not have the primary theme of space exploration and the military complex, alien or human military characters were common, as were scientists who worked for the military. A central component of cultivation theory is that opinions and beliefs are built over time, through repeated exposure to the same or similar messages (Gerbner, 1987). In looking at science fiction television, it would be the frequent viewers who are susceptible to influence, and the most prolific images would be the ones that exerted the greatest influence. In this case, the regular and sometimes very prominent presence of military in science fiction television shows—the military's use of science and its influence on science research—may foster perceptions of a close association between the military and science. If individuals view the military as a potentially harmful and destructive force, associations between the military and science could create perceptions that science is also harmful and dangerous.

Harmful vs. beneficial: The harmful versus beneficial portrayals of science, and the extent to which science and scientists were portrayed as harmful and dangerous versus beneficial, was the focus of the fourth research question. The finding that both scientists and science are most often portrayed as beneficial can be safely considered a positive factor for any science teachers contemplating the use of science fiction television to stimulate student interest in science. However, science itself is portrayed as harmful and dangerous almost as often as it is beneficial. If frequent viewers of science fiction are influenced by images and portrayals, they

would be more likely to perceive science as potentially harmful and dangerous. Further, if film and television entertainment have the power to inform public debate and opinion (Elliot & Rosenberg, 1987), and influence public decisions about policies (McCurdy, 1995), then science fiction-inflated perceptions of dangerous and harmful science could have an influence on public opinion and action toward funding civil science programs and organizations.

Additionally, harmful and beneficial portrayals of science were often seen together in the same episode. Science was frequently both the cause and the solution, both good and bad. Lambourne, Shallis and Shortland (1990) claimed that these types of contradictory and mixed messages about science create confusion in the viewer's mind, which contributes to an uncertainty about science. Public uncertainty about science is a well-documented problem (Zehr, 1999), and based on findings in this study, it is possible that regular viewers of science fiction television may express more uncertainty about science than non-viewers.

The dramatic increase in the number of episodes portraying science as harmful and dangerous was the most notable finding when looking at the changes in science fiction television over time, which was the focus of the last research question. The beneficial portrayals of science and scientists remained fairly consistent over time, but the harmful portrayals of science shot up dramatically in the mid 1990s and continued to climb through 2007. It is unclear whether some social or political event prompted this sudden trend. It is however clear that the greater the number of harmful portrayals of science, the greater the possibility those portrayals will adversely influence science fiction viewer's opinions about science.

Implications and Recommendations

When considering the fact that most people do not have personal relationships or interactions with scientists (Nelkin, 1995), the second point of consideration should be, what

images and sources are constructing public perception of science and scientists? This study examined one of those sources and the images it funnels into the public consciousness—science fiction television shows. The implications of these findings may be of interest to several groups, including teachers, scientists, science policy makers and advocates, and other researchers investigating images and representations of science in entertainment.

Teachers and Education

Given the overall positive portrayals of scientists, and the previous successes using science fiction films and literature to teach science, science fiction television has the potential to be a very useful tool in introducing students to scientists, and inspiring interest in science-related careers. Many scientists have said science fiction inspired their own interest in becoming a scientist (NSF, 2002; Wells, 2000). Science fiction television programs allow students unique access to otherwise intangible people and their experiences with science. They can get to know scientist characters whose appearance and personality are not dramatically different from people they themselves may know, such as family or friends. For example, a science teacher might ask students to watch an episode of a science fiction television show and write a short paragraph about each scientist character—their personality, appearance, morality and ethics. An activity such as this might help students see a scientist as that regular guy/girl. If students see a scientist as a regular guy/girl, it may be easier for them to envision themselves as a scientist, helping to make a career in science both realistic and attainable.

Scientists

Scientists themselves may be pleased to know their small screen image has dramatically improved and progressed from that of the 1950s mad scientist. Having an awareness of the potential influences of science fiction on public opinion of science, and possibly science policy

and funding may inspire scientists to make themselves available as consultants to television and film producers and writers. Scientists working as consultants on films and television programs can help to build public appreciation of science (Kirby, 2003a). A scientist's input into the production of science-based entertainment can help improve both accuracy and authenticity. Furthermore, scientists who regularly work as consultants on films and television programs may experience increased recognition of their own work, and also gain a better understanding of how to translate and communicate their science to a general public. Increased public recognition and a better public understanding could lead to improved public support and funding for sciences.

Policy Makers and Advocates

Rosenstone (2003) discussed the power of images to create metaphorical truths about science and scientists. In absence of personal experience, science and scientists operate in an invisible sphere open to unrestricted interpretation by entertainment writers and producers. If science fiction television shows continue to increase in popularity and numbers, scientists, science policy makers and advocates may want to consider the increasingly influential role science fiction plays in interpreting science. The images in science fiction television shows, whether harmful or beneficial, real or imaginary, have the potential to construct metaphorical truths that linger in the minds of viewers—truths that could influence viewer's support or opposition of civil science funding. For example, if a regular science fiction viewer religiously watches *Stargate Sg-1* or *The X-Files*, two shows in which the government routinely covers up scientific discoveries, that viewer may come to perceive government-funded science as plagued by secrecy and conspiracy. Considering fictional images and the resulting metaphorical truths can inform public opinion and influence action (Elliot & Rosenber, 1987; McCurdy, 1995), this perception of government secrecy might influence a viewer to vote against funding civil science

programs such as NASA. An implication of this magnitude should be a concern for civil science organizations like the National Science Foundation.

Social Research

The results of this study would serve as a good starting point, and a basis for comparison, for any researchers investigating the influence of television shows on audience opinion and action, or the images of science in entertainment. The results of this study could also be useful to educational researchers exploring different ways in which to rejuvenate student interest and enrollment in science and engineering programs.

Limitations

It is not possible to say whether the representations of science and scientists in science fiction television would be seen in science fiction films, or films in other genres. In comparing the finding of Weingart's (2003) study of Hollywood films with the results of this study, it would seem that science and scientists may actually be portrayed differently in film than they are in television.

Future Research

There is vast potential for future research into the role of entertainment in communicating science, largely because so little research has focused on this area in the past. Entertainment in film, television, video games, and the Internet all beg the question, how do they represent science? And how are those representations impacting the audience? The most obvious future research would be to implement a survey or experiment investigating the regular science fiction viewer—their viewing habits, pre-existing interests in science, education and profession. One important question is whether or not frequent viewing of science fiction actually improves science literacy by building familiarity through exposure. If it does, then it is reasonably safe to

say that the most frequently portrayed sciences are the ones with which viewers will become most familiar. Based on the findings in this study, it could be expected that regular science fiction viewers would be more science literate in physics, astronomy and medical sciences, than non-science fiction viewers.

Another point of investigation might examine whether regular viewers of science fiction television express more uncertainty about science than non-viewers. Frequent exposure to the contradicting portrayals of science as both beneficial and harmful may increase an individual's uncertainty about science and scientists. However, in investigating this point it would be important to account for the possibility that science fiction viewers may have a greater familiarity with, and interest in science, two factors that might nullify any potential influences of harmful portrayals of science or scientists.

A study examining historical events might lend some insight into the dramatic increase in the harmful portrayals of science, which have more than tripled over the last two decades and appears to be on the rise. This trend to portray science as increasingly harmful is concerning. The more prolific these portrayals are, the more potential they have to negatively influence public opinions about science and scientists.

Conclusion

The goal of this study was to document the representations of science and scientists in science fiction television, and to investigate potential implications of these representations. A secondary, and equally important goal, was to contribute to the limited research focusing on science communication through entertainment, and to inspire continued research in this area. It is believed that through understanding the potential of entertainment media to communicate

science, they could be employed to improve public science literacy and inspire the next generation of scientists.

Discovering that modern science fiction television favorably portrays scientists, but includes contradicting portrayals of science, is one step toward a greater understanding of how entertainment is representing science and potentially influencing the public. The discovery that the regular guy/girl image is now the dominant portrayal of science fiction television scientists could signify a monumental change in the way the public perceives scientists and science, and the way entertainment portrays them. Considering science is central to our social, political and economic progress, understanding the relationship between science, entertainment, and the public is vitally important.

APPENDIX A DEFINITIONS

SCIENCE. Science is an organized body of knowledge attained through a system of observation and experimentation, which is used to describe and explain the physical world natural phenomena.

SCIENTISTS. Scientists are any individual who has attained and practices a professional level of expertise in any social or physical science.

SCIENCE FICTION. To be considered science fiction, a television show must fulfill two prerequisites:

- 1) Scientific credibility and plausibility are a central element of the events, societies and technologies depicted in the stories and plots.
- 2) At least one traditional science fiction theme or sub-theme is evident.

SPACE EXPLORATION AND THE MILITARY INDUSTRIAL COMPLEX THEMES. Themes included in this category are space travel and exploration, colonization and exploitation of other worlds, warfare and weaponry, galactic empires and space operas.

ALIENS AND MONSTERS THEMES. Themes included in this category are first contacts and other encounters, biologies, environments and societies, invasions and aliens among us, artifacts and technologies.

FUTURE OR ALTERNATE HUMAN SOCIETIES THEMES. Themes included in this category are alternative histories, utopias and nightmares, cities and cultures, transport, communications and technology, cataclysms and dooms, sex and cultural taboos, religion and philosophy.

MEN AND SUPERMEN THEMES. Themes included in this category are mutants, prodigies and symbiotes, telepathy, psionics and ESP, medicine and bionics.

ROBOTS, COMPUTERS AND GADGETS THEMES. Themes included in this category are robots, androids and gadgets, computers and cybernetics.

EXTRA DIMENSIONS THEMES. Themes included in this category are Time travel and lost worlds, Parallel worlds and extra dimensions.

Themes were adapted from *The Visual Encyclopedia of Science Fiction* (1978) and edited by Brian Ash, as cited in Lambourne, Shallis & Shortland (1990)

APPENDIX B
SCI-FI LISTS TOP 100 SCIENCE FICTION TELEVISION SHOWS

Old	Rank	Series	On-Air	# Episodes	Length	Source
1	1	<u>Star Trek - The Next Generation</u>	1987-1994	176	60*	synd
2	2	<u>Stargate SG-1</u>	1997-X	214+	60	Show/SF
3	3	<u>Battlestar Galactica (new)</u>	2003-X	58+	60	SciFi/Sky
5	4	<u>Star Trek (Original Series)</u>	1966-1969	79	60	NBC
4	5	<u>The X-Files</u>	1993-2002	202	60	Fox
6	6	<u>Firefly</u>	2002	15	60	Fox
7	7	<u>Babylon 5</u>	1993-1999	115	60*	syn/TNT
8	8	<u>Farscape</u>	1999-2003	88	60	SciFi
9	9	<u>Star Trek - Deep Space Nine</u>	1993-1999	174	60*	synd
10	10	<u>Star Trek - Voyager</u>	1995-2001	171	60*	UPN
11	11	<u>The Twilight Zone</u>	1959-1964	156	30/60	CBS
12	12	<u>Futurama</u>	1999-2003	72	30	Fox
13	13	<u>Doctor Who</u>	1963-1989	694	30*	BBC
14	14	<u>Stargate - Atlantis</u>	2004-X	60+	60	SciFi
16	15	<u>Lost</u>	2004-X	58+	60	ABC
15	16	<u>Red Dwarf</u>	1988-1999	52	30	BBC
17	17	<u>Star Trek - Enterprise</u>	2001-2005	98	60	UPN
18	18	<u>Quantum Leap</u>	1989-1994	95	60*	NBC
21	19	<u>Doctor Who (2005)</u>	2005-X	29+	45	BBC
19	20	<u>Battlestar Galactica (original)</u>	1978-1980	34	60*	ABC
22	21	<u>The Outer Limits</u>	1963-1966	49	60	ABC
20	22	<u>Smallville</u>	2001-X	121+	60	WB
23	23	<u>Sliders</u>	1995-2000	88	60	Fox/SF
24	24	<u>V</u>	1984-1985	24	60*	NBC
25	25	<u>Hitchhiker's Guide to the Galaxy</u>	1981	6	35	BBC
27	26	<u>Dark Angel</u>	2000-2002	43	60	Fox
26	27	<u>The Prisoner</u>	1967-1968	17	60	ITV
28	28	<u>Blake's 7</u>	1978-1981	52	60	BBC
31	29	<u>Mystery Science Theater 3000</u>	1988-1999	197	90	Com/SF
29	30	<u>Lost in Space</u>	1965-1968	83	60	CBS
30	31	<u>Space 1999</u>	1975-1977	48	60	ITV
33	32	<u>The Avengers (with Emma Peel)</u>	1965-1967	50	60	ITV
32	33	<u>Space - Above and Beyond</u>	1995	22	60	Fox
35	34	<u>The 4400</u>	2004-X	32+	60	USA
34	35	<u>Andromeda</u>	2000-2005	110	60	synd
36	36	<u>The Man From U.N.C.L.E.</u>	1964-1968	105	60	NBC
38	37	<u>Third Rock From the Sun</u>	1996-2001	139	30	NBC
37	38	<u>Lois & Clark (New Superman)</u>	1993-1997	88	60	ABC
40	39	<u>Alien Nation</u>	1989-1990	21	60*	Fox
39	40	<u>The Six Million Dollar Man</u>	1973-1978	100	60*	ABC
41	41	<u>Buck Rogers in the 25th Century</u>	1979-1981	33	60*	NBC
43	42	<u>seaQuest DSV (& 2032)</u>	1993-1995	53	60	NBC
44	43	<u>Max Headroom - The Series</u>	1987-1988	14	60*	ABC

42	44	<u>Roswell</u>	1999-2002	61	60	WB/UPN
45	45	<u>Alias</u>	2001-06	105	60	ABC
46	46	<u>UFO</u>	1970-1971	26	60	ITV
50	47	<u>Voyage to the Bottom of the Sea</u>	1964-1968	110	60	ABC
58	48	<u>Heroes</u>	2006	23+	60	NBC
47	49	<u>The Wild, Wild West</u>	1965-1969	104	60	CBS
48	50	<u>Thunderbirds</u>	1965-1966	32	60	ATV
53	51	<u>Time Tunnel</u>	1966-1967	30	60	ABC
49	52	<u>Lexx</u>	1997-2002	61	90/60	synd/SF
52	53	<u>The Outer Limits (new)</u>	1995-2002	154	60	Show/SF
55	54	<u>Kolchak - The Night Stalker</u>	1974-1975	20	60	ABC
51	55	<u>Batman</u>	1966-1968	120	30	ABC
54	56	<u>ALF</u>	1986-1990	102	30	NBC
61	57	<u>The Adventures of Superman</u>	1953-1957	104	30	ABC
63	58	<u>Cowboy Bebop</u>	1998	26	30	TV Tokyo
65	59	<u>The Invaders</u>	1967-1968	43	60	ABC
56	60	<u>Crusade</u>	1999	13	60	TNT
57	61	<u>The Jetsons</u>	1962-1963	24	30	ABC
67	62	<u>My Favorite Martian</u>	1963-1966	107	30	CBS
60	63	<u>Logan's Run</u>	1977-1978	13	60	CBS
64	64	<u>Millennium</u>	1996-1999	67	60	Fox
59	65	<u>Wonder Woman</u>	1974-1979	57	60	ABC/CBS
62	66	<u>The (New) Twilight Zone</u>	1985-1987	36	60/30	CBS/synd
68	67	<u>Earth - Final Conflict</u>	1997-2002	110	60	synd
69	68	<u>Adventures of Brisco County Jr</u>	1993-1994	27	60/P	Fox
66	69	<u>The Incredible Hulk</u>	1977-1982	79	60	CBS
74	70	<u>Planet of the Apes</u>	1974	14	60	CBS
70	71	<u>Mork and Mindy</u>	1978-1982	92	30*	ABC
71	72	<u>Sapphire and Steel</u>	1979-1982	34	30	ATV
72	73	<u>Amazing Stories</u>	1985-1987	43	30*	NBC
73	74	<u>The Bionic Woman</u>	1976-1978	57	60	ABC/NBC
75	75	<u>Earth 2</u>	1994-1995	22	60/P	NBC
76	76	<u>The Greatest American Hero</u>	1981-1983	44	60	ABC
83	77	<u>Dune (2000)</u>	2000	3	120	SciFi
77	78	<u>Land of the Giants</u>	1968-1970	51	60	ABC
78	79	<u>Taken</u>	2002	10	120	SciFi
88	80	<u>Eureka</u>	2006-X	12+	60	SciFi
90	81	<u>Science Fiction Theatre</u>	1955-1957	78	30	synd
80	82	<u>Get Smart</u>	1965-1969	138	30	NBC/CBS
79	83	<u>The Flash</u>	1990-1991	22	60	CBS
81	84	<u>Quatermass Serials</u>	1953-1959	18	30/35	BBC
84	85	<u>Star Trek (Animated Series)</u>	1973-1974	22	30	NBC
82	86	<u>VR.5</u>	1995	13	60/120	Fox
85	87	<u>The Invisible Man</u>	2000-2002	46	50	SciFi
87	88	<u>Invasion</u>	2005-06	22	60	ABC
92	89	<u>Ghost in the Shell: SAC</u>	2002-04	52	30	Prod IG

86	90	<u>Dark Skies</u>	1996-1997	19	60	NBC
89	91	<u>Captain Scarlet & the Mysterons</u>	1968	32	30	ITV
91	92	<u>War of the Worlds</u>	1988-90	41	60	synd
93	93	<u>The Tomorrow People</u>	1973-1979	22	30	ITV
94	94	<u>Surface</u>	2005-06	15	60	NBC
96	95	<u>Neon Genesis Evangelion</u>	1995-96	26	30	Gainax
95	96	<u>Threshold</u>	2005	14	60	CBS
97	97	<u>The Champions</u>	1968-1969	30	60	ITV
98	98	<u>Eerie, Indiana</u>	1991	19	30	NBC
99	99	<u>Odyssey 5</u>	2002-03	20	60	Showtime
100	100	<u>Survivors</u>	1975-1977	38	60	BBC

Episodes aired and scheduled as of 15 November 2006

* Features of other lengths also produced

The Television List

Sci-Fi Lists is dedicated to bringing you quality lists and concise reviews of science fiction's all-time top books, films, TV shows and short stories. The Top 200 Sci-Fi Books list is the flagship of the site, but lists have also been compiled for movies and television with the aim of being the most statistically reliable of their type found anywhere on the net. All lists are regularly updated to include new sources of information that become available, including results from the relevant *Sci-Fi Lists* online polls.

Experts polled - 11; Published critics - 6; Popular polls - 9; Other lists - 90

Based on data gathered from a statistical survey and a direct poll of sci-fi television experts - including critics, editors and Web site managers. Shows often classified under other genres but containing significant and notable sci-fi content (e.g. *The Avengers & The Wild, Wild West*) qualify for inclusion on the list. (Updated 29 September 2007)

Sykes, P. (2007, November, 27). *Sci-fi lists - top science fiction*. Retrieved November 23, 2007, from <http://home.austarnet.com.au/petersykes/topscifi/index.html>

APPENDIX C
CODING

Coding Sheet *

1. Item Number: _____
2. Name of Show: _____
3. Episode Name: _____
4. Air Date: ____/____/____
5. Network: _____

6. What kinds of scientists are portrayed in the show? (Answer items a-j for each scientist)
 - a. Character name: _____ (Internet research may be required)
 - b. Gender: _____ 1- Male 2- Female 0- Unknown
 - c. Ethnicity: Mark 1 for White OR Mark 2 for Non-white: _____
Mark 3 if scientist is also an Alien: _____

 - d. Type of Scientist: _____
(Mark 3 for the dominant type, mark 1 for all others that apply)
 - 1—**Astronomer** (astrophysicist)
 - 2—**Physicist** (science of matter and motion, space-time, energy, force and mass)
 - 3—**Mathematician**
 - 4—**Chemist** (biochemist, nanotechnologist, laboratory scientist)
 - 5—**Biologist** (botanist, entomologist, geneticist, herpetologist, microbiologist, neuroscientist, pharmacologist, virologist, zoologist)
 - 6—**Ecologist** (soil scientist, life scientist, atmospheric scientist, toxicologist)
 - 7—**Geologist** (mineralogist, seismologist, gemologist, volcanologist)
 - 8—**Medical Doctor** (physician, surgeon, psychiatrist)
 - 9—**Engineer** (mechanical, chemical, industrial, electrical, nuclear, civil)
 - 10—**Computer Scientist** (computer engineer/designer, programmer, roboticist)
 - 11—**Social Scientist** (psychologist, sociologist, historian)
 - 12—**Anthropologist** (biological, forensic, cultural)
 - 13—**Archeologist** (Egyptologist, ethnoarcheologist, Paleolithic)

* Coding was entered directly into an Excel spreadsheet. This coding sheet is a summary of the Excel spreadsheet and was meant to be used for reference purposes only, not as the actual coding instrument.

14—**Fictional or Futuristic Scientist**

15—**Paranormal Scientist** (ghosts, ESP, UFOs, vampires, werewolves)

16—**Other/Unknown** (List)

e. Morality and Ethics: _____

(Mark only one)

1- Good 2- Bad 3- Both 0- Neutral

f. Personality:

(Mark 3 for the dominant type, mark 1 for all others that apply)

Openness: _____

Conscientiousness: _____

Extraversion: _____

Agreeableness: _____

Neuroticism: _____

g. Characterizations:

(Mark 3 for the dominant characterization, mark 1 for all others that apply)

Comical: _____

Nerd: _____

Absent-minded: _____

Mad scientist: _____

Hero: _____

“Indiana Jones”: _____

Charmer: _____

Genius: _____

“Regular” guy/girl: _____

Other (describe): _____

h. Physical Appearance:

(Mark 1 for all that apply)

Glasses: _____

Laboratory coat/attire: _____

Pocket protector: _____

Weapon: _____

Symbols of knowledge: _____

Uniform: _____

Neat/groomed: _____

Messy: _____

Attractive: _____
Age: under 20_____ 20s_____ 30s_____ 40s_____ over 50_____

Other (describe): _____

i. Works for or with the Military: _____

Mark: 1 – Yes 2 – No 0 – Unknown

j. Works for or with the Government: _____

Mark: 1 – Yes 2 – No 0 – Unknown

k. Has a Love Interest: _____

Mark: 1 – Yes 2 – No

l. There are no scientist characters: _____

Mark: 1 – Yes

7. Which sciences are being portrayed in the episode:

(Mark 3 for the dominant science, mark 1 for all others that apply)

Astronomy: _____

Physics: _____

Chemistry: _____

Biology: _____

Ecology: _____

Geology: _____

Medical: _____

Engineering: _____

Computer/Technology: _____

Social (psychology, sociology, history): _____

Anthropology: _____

Archeology: _____

Fictional or Futuristic: _____

Paranormal: _____

Other (list science): _____

8. Where is science taking place:

(Mark 3 for the dominant location, mark 1 for all others that apply)

Laboratory: _____

Off-world (other planets): _____
Outer Space (spaceships/space stations): _____
Underwater: _____
Government facility: _____
Military base/facility: _____
Office/business/corporation: _____
City/urban: _____
Wilderness: _____
Secret location: _____
Other (list location): _____

9. What themes are present in the episode:

(Mark 3 for the dominant theme, mark 1 for all others that apply)

Space exploration and the military industrial complex: _____

Space travel and exploration
Colonization and exploitation of other worlds
Warfare and weaponry
Galactic empires and space opera

Aliens and monsters: _____

First contacts and other encounters
Biologies, environments and societies
Invasions and aliens among us
Artifacts and technologies

Future or alternate human societies: _____

Alternative histories
Utopias and nightmares
Cities and cultures
Transport, communications and technology
Cataclysms and dooms
Sex and cultural taboos
Religion and philosophy

People and Superhumans: _____

Mutants, prodigies and symbiotes
Telepathy, psionics and ESP
Medicine and bionics

Robots, computers and gadgets: _____

Robots, androids and gadgets

Computers and cybernetics

Extra dimensions: _____

Time travel and lost worlds

Parallel worlds and extra dimensions

Other (list theme): _____

10. How science is communicated:

(Mark 3 for the dominant form, mark 1 for all others that apply)

By a scientist explaining a science to another scientist or non-scientist: _____

In an email, letter, book or other text: _____

By an alien: _____

Intelligent computer: _____

Artificial life-form or robot: _____

Quotes or messages from real or fiction references: _____

Through the process of discovery: _____

11. How is the science being used:

(Mark 1 for all that apply)

Using science to provide a description of a real but relatively unfamiliar environment: _____

Using science to provide a description of an imaginary environment that is as consistent as possible with established facts and principles: _____

Using a piece of scientific information as the basis of a puzzle: _____

Using science to justify the existence of devices or processes: _____

Using the scientific process itself or using a credible scientific setting for a story: _____

Using science peripherally, to justify a device or process, or to provide a generally 'scientific' background: _____

For items 12 – 13

Mark: 1 – Yes 2 – No

12. Is the science portrayed as beneficial: _____

13. Is the science portrayed as dangerous or harmful: _____

14. Are the scientists portrayed as beneficial: _____

15. Are the scientists portrayed as dangerous or harmful: _____

Codebook

1. **Item Number** (pre-entered by researcher)

2. **Name of Show**—Use the following numbers to indicate the name of the television show:
(pre-entered by researcher)
 - SG1—Stargate SG-1
 - XF—The X-Files
 - TNG—Star Trek - The Next Generation
 - B5—Babylon 5
 - D9—Star Trek - Deep Space Nine
 - VOY—Star Trek - Voyager
 - BG—Battlestar Galactica (new)
 - FAR—Farscape
 - SA—Stargate - Atlantis
 - SML—Smallville
 - QL—Quantum Leap
 - ENT—Star Trek Enterprise
 - LST—Lost
 - SLI—Sliders
 - FF—Firefly
 - DA—Dark Angel
 - AND—Andromeda
 - HRO—Heroes
 - 44—The 4400
 - SAB—Space: Above and Beyond

3. **Episode Name**—Enter the name of the episode as it appears on the DVD cover or in the beginning of the show. (pre-entered by researcher)

4. **Air Date**—Enter the date that the episode originally aired. In most cases the date is given on DVD cover. Enter date as: mm/dd/yy. (pre-entered by researcher)

5. **Network**—Enter number that corresponds to the network the show originally aired on. Enter 7 if the show was a first-run syndication; *Star Trek - The Next Generation* and *Star Trek Deep Space Nine* will fall into this category. (pre-entered by researcher)
 - 1—Sci-Fi
 - 2—FOX
 - 3—TNT
 - 4—UPN
 - 5—Sky
 - 6—WB

- 7—NBC
- 8—ABC
- 9—USA
- 10—Syndicated

6. What kinds of scientists are portrayed in the show—Answer each item (a-k) for each individual scientist character. Note: A scientist who appears in multiple episodes may or may not have the same morality, characteristics, personality, physical appearance, etc. in the different episodes.

m. Character #—Number characters consecutively, beginning with.

n. Gender— Enter number that corresponds to character’s gender.

1—**Male**

2—**Female**

0—**Unknown**

o. Ethnicity—Enter number that corresponds to character’s ethnicity, either white or non-white. If scientist is an alien, mark 3 for Alien, and if the alien scientist is human or human-looking (not a creature or animal), then also mark either 1 or 2 to indicate the alien scientist’s ethnicity. If a character is from another planet, but is human, they are considered alien. For the purpose of this study, ‘alien’ means, not from Earth. If the scientist is not alien, mark only 1 or 2 for white or non-white.

p. Type of Scientist— Enter number that corresponds to the type of scientist portrayed by the character. One character may be more than one type of scientist. For example, if a character appears to be both an astronomer and an engineer, mark both, but also indicate which is dominant. Mark 3 for the DOMINANT type, mark 1 for ALL others that apply.

Paranormal Scientists include any scientist character that specializes in the paranormal, including ghosts, psychic abilities (ESP), UFOs, and mythical creatures such as vampires and werewolves.

Characters such as Dr. Who would fall into the **Fictional or Futuristic Scientist** category because his character portrays a kind of scientist that does not exist in real science. If it is not possible to determine what type of scientist is being portrayed, then mark Other and describe.

1—**Astronomer** (astrophysicist)

2—**Physicist** (science of matter and motion, space-time, energy, force and mass)

3—**Mathematician**

4—**Chemist** (biochemist, nanotechnologist, laboratory scientist)

5—**Biologist** (botanist, entomologist, geneticist, herpetologist, microbiologist,

- neuroscientist, pharmacologist, virologist, zoologist)
- 6—**Ecologist** (soil scientist, life scientist, atmospheric scientist, toxicologist)
- 7—**Geologist** (mineralogist, seismologist, gemologist, volcanologist)
- 8—**Medical Doctor** (physician, surgeon, psychiatrist)
- 9—**Engineer** (mechanical, chemical, industrial, electrical, nuclear, civil)
- 10—**Computer Scientist** (computer engineer/designer, programmer, roboticist)
- 11—**Social Scientist** (psychologist, sociologist, historian)
- 12—**Anthropologist** (biological, forensic, cultural)
- 13—**Archeologist** (Egyptologist, ethnoarcheologist, Paleolithic)
- 14—**Fictional or Futuristic Scientist**
- 15—**Paranormal Scientist** (ghosts, ESP, UFOs, vampires, werewolves)
- 16—**Other**

q. Morality and Ethics— Enter number that corresponds to the morality and ethics of the scientist. Mark only ONE.

- 1—**Good** if character’s intentions, goals and/or actions appear moral, ethical, helpful or positive. The scientist is generally honest and exhibits feelings guilt for dishonest or harmful acts and situations.
- 2—**Bad** if their intentions, goals and/or actions appear to be immoral, unethical, evil, destructive or harmful. The scientist is consistently dishonest and/or does show feelings of guilt for harmful actions or situations.
- 3—**Both** if they exhibit characteristics of good and bad morality, maybe a double agent, or a character torn between serving to conflicting goals. A story about personal growth and lessons learned might fall into this category, for example if a character is malevolent or unethical in the beginning of the episode, and then changes through the episode as they realize the consequences of their actions. Another example might be a character who exhibits both good and bad morality throughout the show. It is also possible that what is considered bad by some characters may be considered good by others – leaving the perpetrator of the actions in a grey area – both good and bad morality and ethics.
- 0—**Neutral** if the character cannot be considered good or bad, or if it is unclear whether they are good or bad.

r. Personality—Indicate whether or not the character has any of the listed personality traits. Mark 3 for the DOMINANT type, mark 1 for ALL others that apply. If none apply, then leave blank.

Openness: appreciation for art, emotion, adventure, unusual ideas, imagination, curiosity, and diverse experience.

Conscientiousness: self-discipline, act dutifully, aim for achievement; planned rather than spontaneous behavior.

Extraversion: energy, positive emotions, and the tendency to seek stimulation and the company of others.

Agreeableness: a tendency to be compassionate and cooperative rather than suspicious and antagonistic towards others.

Neuroticism: tendency to experience unpleasant emotions easily—anxiety, depression, or vulnerability; also considered emotional instability.

- s. **Characterizations**— Indicate whether or not the any of the listed characterizations describe the scientist. Mark 3 for the DOMINANT characterization, mark 1 for ALL others that apply. If none apply, then leave blank.

Comical: exhibits humor through dialog and actions, makes jokes, acts silly or goofy.

Nerd: socially awkward, may be antisocial or have few friends – most of whom are scientists, uncomfortable around the opposite sex, no separation between work and play – they are one in the same, often portrayed as being isolated in their work and life.

Absentminded: forgetful, preoccupied with thoughts of work.

“Mad” scientist: unpredictable, malevolent, immoral, wicked, malicious, villainous, no regard for others, does not take responsibility for problems resulting from actions or work.

Hero: brave, daring, gutsy, risks self for others.

“Indiana Jones” type: adventurous, athletic, bold, confident, probably popular with the opposite sex, often portrayed as a leader, and someone who others look up to.

Charmer: smooth, polished, polite, suave, popular with opposite sex, romance/romantic encounters are frequent and/or openly desired by this character.

Genius: the scientist’s intelligence is made clear by direct mentions; character is referred to as brilliant, a mastermind, having a highly developed intellect.

Regular guy/girl: may have other characterizations, but is not dramatically different than other characters, upon first observation it is not obvious that the character is a scientist.

Other: describe the characterization in a few words.

- t. **Physical Appearance**—Indicate which of the listed physical appearances apply to the character. If they wear a lab coat, have a pocket protector, wear glasses or carry/use a weapon in even just one scene during the episode, mark “1” for yes next

to these categories. For all others, mark 1 only if it applies to the majority of their appearances in the episode. Mark 1 for ALL that apply. If none apply, then leave blank.

Glasses: eye glasses or spectacles (do not count sunglasses).

Laboratory coat/attire: lab coat or other laboratory attire such as scrubs, clean-room gear, hazmat suit, etc.

Pocket protector: do they have a pocket protector.

Weapon: does the character carry or use a weapon such as a knife, gun, etc.

Uniform: a uniform of any kind, including military, fictional, do not count lab attire.

Symbols of Knowledge: any symbol of knowledge used or carried by the character: books, computers, lab equipment such as microscopes or beakers, including any fictitious science equipment or devices.

Neat/groomed: a tidy appearance, clean, neat and combed hair, clean/wrinkle-free attire, organized appearance.

Messy: un-kept hair and clothes, un-shaven, disorganized appearance, shirt may be partially un-tucked, might have glasses that always appear crooked.

Attractive: mark 1 for yes if the character considered attractive by other characters, and/or the character a generally attractive person – use best personal judgment.

Age: use best personal judgment to determine the approximate age of the character.

Other: describe appearance in a few words.

- u. Works for or with the Military**—does the scientist directly work for or with the Military, or are they member of the armed forces. Only code Yes if they are intentionally, knowingly and of their own free will producing or doing work for the military, and that fact is made clear to the audience. Mark 1 – Yes, 2 – No, or 0 – Unknown.

- v. Works for or with the Government**—does the scientist directly work for or with the government. Only code Yes if they are intentionally, knowingly and of their own free will producing or doing work for the government. Mark 1 – Yes, 2 – No, or 0 – Unknown.

- w. Has a Love Interest**—does the character have a love interest, relationship, crush, fling, or any romantic encounter beyond a single moment of gestures, for example, do not count one kiss or a romantic hug as a love interest if that encounter is not revisited or mentioned again by the story and other characters. Mark 1 – Yes, 2 –

No. If there is no indication that the character has a love interest, or it is unknown whether or not the character has a love interest, then mark 2 for No.

- x. **There are No scientist characters**—there are no characters who can be identified as scientists either by their work, interaction with others or self-identification. Mark 1 if this is the case.

7. **Which sciences are being portrayed in the episode**—Mark 3 for the DOMINANT science and mark 1 for ALL others that apply.

Astronomy: including astrophysics, planetary sciences, amateur observation

Physics: science of matter and motion, space-time, energy, force and mass

Math: complex numbers and calculations

Chemistry: biochemistry, nanotechnology, laboratory sciences

Biology: botany, entomology, genetics, herpetology, microbiology, neuroscience, pharmacology, virology, zoology

Ecology: soil sciences, agriculture, life sciences, atmospheric, toxicology

Geology: mineralogy, seismology, gemology, volcanology

Medical: medical diagnoses/procedures, surgery, psychiatry

Engineering: mechanical, chemical, industrial, electrical, nuclear, civil, programming, robotics

Social: psychology, sociology, history, communication

Anthropology: forensics, cultural anthropology

Archeology: Egyptology, ethnoarcheology, Paleolithic archeology

Fictional or Futuristic: made-up type of science

Paranormal: ghosts, ESP, UFOs, vampires, werewolves

Other: (list science)

8. **Where is science taking place**—Mark 1 for all that apply.

Laboratory: labs contain tools and equipment for doing the related science, may be in any of the below locations.

Off-world: including other planets or moons, other dimensions/times.

Space: science being done on a space ship or space station.

Underwater: in any large body of water (oceans, lakes, etc.) on or off-world

Government facility: any government facility/office not including military bases, may include off-world or alien government facilities.

Military base/facility: any military base or facility, may include off-world or alien military facilities.

Office/business/corporation: any business/professional setting that does not fall into lab, military or government categories. May include stores, restaurants or other places of business. May be off-world or in space.

City/urban: any urban or metropolitan area, large and small cities and towns.

Wilderness: including farms, ranches, rural areas not part of a town or city, any area far removed from civilization or inhabitants.

Secret location: covert, high security, guarded, top secret, purposely hidden. Note the secret location in the “Other” column. If an underwater military base is secret, mark 1 for underwater, 1 for military base and 1 for secret location, and then note “secret underwater military base” in the “Other” column.

Other: (list location or note any other locations, or secret locations)

9. **What themes are present in the episode:** Mark 3 for the DOMINANT theme, and mark 1 for ALL others that apply.

Space exploration and the military industrial complex

Space travel and exploration: exploring other worlds, celestial bodies, other solar systems or galaxies. If more than half the story takes place on a space ship, ‘space travel and exploration’ is a significant theme. Space travel and exploration might not use a space ship, as in *Stargate SG-1* and *Atlantis*, space travel and exploration is heavily dependant on the ‘stargate’ and wormholes. A show might have a dominant theme of space travel and exploration with the spaceships. **Colonization and**

exploitation of other worlds: visiting other celestial bodies, such as planets, asteroids, comets, etc. with the purpose of inhabiting or taking over the planet, setting up new colonies, mining resources or obtaining new technology by force or deception.

Warfare and weaponry: mark yes, if military of any kind plays a part in the story, regardless of whether there is an actual war taking place in the individual episode. Do not mark yes if characters carry weapons, but they are never used or directly referenced as part of the story. Warfare might be an ongoing battle with another people or species that is a backdrop for the show, but there is not necessarily an actual battle fought onscreen.

Galactic empires and space opera: *Star Wars* would be an example where ‘galactic empire’ is the dominant theme. A space opera would be a show like the new *Battlestar Galactica*, where dramatic character relationships are the dominant element in the stories. For example, love triangles and other romantic relationships that are plagued by problematic situations, power struggles or other dramatic conflicts between characters, dramatic stories involving the relationships between siblings or parent and offspring.

Aliens and monsters

First contacts and other encounters: encountering alien life is a significant element in the story, either for the first time (first encounter) or repeatedly throughout the episode.

Biologies, environments and societies: the environment is a main focus, such as in a story that is centered on an alien environment and the biological characteristic of the beings that are able to survive there. **Invasions and aliens among us:** invasion might be from other alien or creatures, and might take place on other planets, spaceships or space stations. **Artifacts and technologies:** alien or otherwise

Future or alternate human societies

Alternative histories, Utopias and nightmares, Cities and cultures: could be on planet Earth, in space, or on other celestial bodies, including any alternate society, future or past, but NOT alternate dimensions and parallel worlds or universes. Might include a story based on an imaginary city or culture. **Transport, communications and technology** related to future or alternated societies, **Cataclysms and dooms** as a theme or element of these societies, **Sex and cultural taboos**, and **Religion and philosophy** may also be central themes of these alternate societies.

People and Superhumans

Mutants: the *X-Men* movies and the television show *Heroes* would be examples of stories focused on mutants and/or super-humans. However, Superman would not be considered a mutant, he would be considered an alien because he is from another planet and his abilities are not mutations, they are the natural abilities of his species. **Prodigies** would include characters who are a master of one or more skills, they have an extraordinary talent or ability, **and symbiotes**, organisms that must have a host to live, this could include intelligent alien species that takeover and control human hosts, or aliens that have a mutual symbiotic relationship with a host. If the alien symbiote is a main focus in a story, rather than the human host, it would be more appropriate to choose “Aliens and Monsters” as a dominant theme. **Telepathy:** sensing of thoughts or feelings without the help of the five known senses (sight, smell, touch, taste, hearing), **psionics:** study of using the mind to induce paranormal phenomenon such as telepathy and telekinesis, **and ESP:** extrasensory perception – the ability to acquire information through paranormal. Paranormal abilities could include telepathy, precognition (knowledge of future events), clairvoyance (awareness of people, objects or events without the use of the five senses), and ESP (sometimes referred to as a ‘sixth sense’). **Medicine and bionics:** would include super-humans created through medical or bionic technology, such as the *Bionic Woman*. The term ‘bionic’ refers to the transfer of technology between lifeforms and synthetic constructs. If any of these abilities or characteristics are main elements of the story, but it is an alien who has these characteristics, then choose ‘aliens and monsters’ as the dominant theme, and mark ‘people and superhumans’ as a secondary theme.

Robots, computers and gadgets

Robots, androids and gadgets: any show where robots and/or androids play a major role in the story, they mainly serve as a main character around whom a story is built.

Computers and cybernetics: any story centered on computer-based technology may fall into this category.

Extra dimensions

Time travel and lost worlds: traveling in time to the past or future, discovering or searching for lost worlds that existed in ancient times or in mythology, such as Atlantis. A lost world does not have to exist in a different dimension; it may exist in another time period or galaxy. **Parallel worlds and extra dimensions:** other realities that do not exist in the past, present or future of this known reality, but instead exist in parallel universes, dimensions or worlds.

Other: (list theme)

16. **How science is communicated**—Mark 3 for the DOMINANT form, mark 1 for ALL other that apply. If none apply, then leave blank.

By a scientist explaining a science process/discovery/method to another scientist or non-scientist—any scientist character explaining some form of science to another scientist or non-scientist character. Could be a scientist explaining the results of a computer test, a medical procedure or a new technology.

Email, letter, book or other text—this text may be visible to the viewer or may be read aloud by a character.

By an alien—might be an authoritative alien, such as an alien scientist, or advanced being.

Intelligent computer—any computer that has the ability to interact, including supercomputers that have the ability to speak and communicate with other characters, but not robots or computers that have control over their own mobility.

Artificial life-form or robot—cyborgs or robots that can interact and have control over their own mobility—they can move around. The robot may look human, such as *Star Trek's* Data, and may have some organic components, but is considered by most other characters to be an artificial life form – it was created by something or someone, rather than born out of procreation.

Quotes or messages from real or fiction references—any character using a quote or explain or introduce science (he/she/Newton/Einstein/ Dr. Who said.....), verbally citing a real or fictional reference to explain science, (according to the Atlantians,.....). If the science is being communicated through a quote, which a character is reading

from a book or email, mark both categories and choose the medium that appears dominant.

Through the process of discovery—this refers to situations when the audience actually witnesses the science discovery taking place, generally discoveries are made by scientist characters. Examples: the discovery might be witnessed by the crew of a space ship looking out a window, a scientist looking through a microscope, or a scientist discovering something on another planet.

17. **How is the science being used**— Mark 1 for ALL that apply. If none apply, then leave blank.

Using science to provide a description of a real but relatively unfamiliar environment—typically involved other planets or bodies in the solar system, could be a known bodies like Mars or Haley’s Comet.

Using science to provide a description of an imaginary environment that is as consistent as possible with established facts and principles—typically involves planets or places which do not exist in reality.

Using a piece of scientific information as the basis of a puzzle—using science to solve mysteries, using scientific knowledge and deduction to solve a case or riddle—might be a newly discovered alien technology or artifact, an ancient archeological site, or a medical mystery.

Using science to justify the existence of devices or processes—some examples might include hyperspace travel, other dimensions, spaceships, robots, imaginary weapons, telepathy or mind control, regenerative abilities or super powers.

Using the scientific process itself or using a credible scientific setting for a story—explanations or demonstrations of scientific methods, introducing science in a laboratory or related credible science setting, such as an operating room for a scene about regenerative abilities or a spaceship’s engine room in a scene about a hyperdrive.

Using science peripherally, to justify a device or process, or to provide a generally ‘scientific’ background—this category encompasses aspects of the other categories and so there will be some overlap, but this category also serves as a “catch-all” for peripheral science that does not fall into any of the other categories. This could include situations that do not have much actual science, but scientific credibility is assumed by the nature of the story or scene. For example, a spaceship making a jump to light-speed might be one element of a scene in which a space battle is taking place, ion cannons (an imaginary technology) are firing and crew members are teleporting to a nearby planet—there is no actual discussion of the science behind the jump to light-speed, the ion cannons or the teleporting, but it is assumed that science is what makes these things possible. A similar scenario might take place in a

futuristic hospital where a medical procedure is the focus, or a story of an individual who has special abilities because of scientific implants—and outright discussion of the science or technology may not take place, but the science is present and gives credibility and plausibility to the story.

12. Is the science portrayed as beneficial—consider the science beneficial if it is used to preserve life, protect, further development and progress, support justice, solve problems such as health or crime, used for the good of many. Mark 1 – Yes, 2 – No.

13. Is the science portrayed as dangerous or harmful—danger and harm may be assumed when the science is portrayed as being a threat to people, places or things, when there is an emphasis on the potential harm of the science being done, or when science is portrayed as unpredictable, volatile, potentially violent. Mark 1 – Yes, 2 – No.

14. Are the scientists portrayed as beneficial— consider them beneficial if they are portrayed as preserving and protecting life, furthering development and progress, supporting justice and just causes, solving problems such as health or crime, working for the good of many. Mark 1 – Yes, 2 – No.

15. Are the scientists portrayed as dangerous or harmful—consider the scientists dangerous or harmful if they are most often portrayed as having the knowledge and power to be a threat to people, places or things, if they are portrayed as unpredictable, volatile, immoral or unethical with little regard for the sanctity of life. Mark 1 – Yes, 2 – No.

For questions 12 – 15

- a. If is unclear or unknown whether science/scientists are portrayed as harmful or beneficial, and if science or scientists are not clearly portrayed as harmful or beneficial, then mark 2 for No.
- b. If there is not enough science, or there are no scientists in the episode, and it is not possible to easily assess whether science/scientists are being portrayed as harmful or beneficial, then mark 2 for No.

Intercoder Reliability Scores

Test Results for Holsti's Coefficient of Reliability:

Overall Score	.945
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Individual Categories:

Type of Scientist	.969
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Morality	.900
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Personality	.870
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Characterizations	.917
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Physical Appearance	.931
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Attractiveness	.900
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Age	.870
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Works for Military	.850
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Works for Government	.700
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Love Interest	.950
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No Scientists	1.000
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Type of Sciences	.979
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Science Fiction Themes	.967
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Science Beneficial vs. Harmful	.900
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Scientists Beneficial vs. Harmful	.950
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BIOGRAPHICAL SKETCH

Yvonne Price came to the University of Florida for the masters program in science and health communication after finishing her BA in journalism and media studies at Humboldt State University in Northern California. Her research interests center on the communication and representation of science in entertainment media such as film, television and video games.

A nontraditional student, Yvonne did not attend college immediately after graduating high school in Fort Collins, Colorado. Instead, she took over 10 years off to work and travel the world, all the while honing in on her strongest interests and developing a diverse skill set.

Her interests in film and television entertainment started as soon as she was tall enough to reach the dial on cable box and change the channel to HBO—back in the days before remote controls. As a film and media enthusiast she took every opportunity in her early years to broaden her knowledge, taking high school classes in film studies, advertising and journalism. Her interests in science were also present at an early age, and were reignited in 1996 when she took a job working for the United States Antarctic Program at McMurdo Station, Antarctica. She spent three austral seasons working onsite at McMurdo, including one Antarctic winter. While at McMurdo she worked closely with scientists from all nationalities, volunteered to write for the local newspaper—The Antarctic Sun, and learned about the unique operations of isolated television and radio facilities serving a small community.

The time Yvonne spent in Antarctica and traveling the Southern hemisphere changed her life and solidified the direction of her career in the marriage of science and media. She plans to continue presenting and publishing her research, and anticipates attending a doctoral program to support this goal. She also plans to continue teaching video and film production related courses. Her ultimate goal is to facilitate better communication of science to the public by consulting with scientists to turn their research findings into publicly accessible audio-visual presentations.